CHAPTER 22

LIST OF EFFECTIVE TEMPORARY REVISIONS

FOLLOWING IS A COMPLETE LISTING OF ALL ACTIVE TEMPORARY REVISIONS (TR'S). TR'S NOT LISTED SHOULD BE REMOVED. THE ATA NUMBER, CONFIG CODE AND PAGE NUMBER IDENTIFIES THE PAGE PRECEDING THE TR.

TR NUMBER	ATA NUMBER	CONFIG CODE	PAGE NUMBER	TR DATE

NONE

CHAPTER 22

AUTO FLIGHT

LIST OF EFFECTIVE PAGES

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
List of Effective Pages	1	Jun 15/96	
	2	Jun 15/96	
	3	Jun 15/96	
	4	Jun 15/96	
	5	Jun 15/96	
	6	Jun 15/96	
	7	Jun 15/96	
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	10	Jun 15/96	
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	21	Jun 15/96	
	22	Jun 15/96	
	23	Jun 15/96	
	24	Jun 15/96	
	25	Jun 15/96	
	26	Jun 15/96	
Table of Contents	1	Jun 15/94	
	2	Jun 15/94	
	3	Jun 15/94	
	4	Jun 15/94	
	5	Jun 15/94	
	6	Jun 15/94	
	7	Jun 15/94	
	8	Jun 15/94	
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	11	Jun 15/94	
	12	Jun 15/94	
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22-ABBR	106	Nov 15/81	
22-ABBR	107	Nov 15/81	
22-ABBR	108	Nov 15/81	
22-ABBR	109/110	Nov 15/81	
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22-DIAGM	3	May 15/82	
22-DIAGM	4	May 15/85	
22-DIAGM	5	Mar 15/91	
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22-DIAGM	7	May 15/82	
22-DIAGM	8	May 15/82	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
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22-18-00	153/154	May 15/88	
22-18-00	501	Nov 15/81	
22-18-00	502	Aug 15/81	
22-18-00	503	Nov 15/81	
22-18-00	504	Aug 15/81	
22-18-00	505	May 15/82	
22-18-00	506	Aug 15/81	
22-18-01	401	Feb 15/74	
22-18-01	402	Feb 15/74	
22-18-01	403	Feb 15/74	
22-18-01	404	Feb 15/74	
22-18-10	401	Nov 15/73	
22-18-10	402	Feb 15/77	
22-18-10	403	Feb 15/73	
22-18-10	404	Aug 15/76	
22-20-00	1/2	Sep 15/73	
22-21-00	1	Aug 15/82	
22-21-00	2	Aug 15/82	
22-21-00	3/4	Sep 15/73	
22-21-00	5/6	Sep 15/79	
22-21-00	7	Sep 15/73	
22-21-00	8	Sep 15/73	
22-21-00	9	Aug 15/82	
22-21-00	10	Aug 15/82	
22-21-00	11	Aug 15/81	
22-21-00	12	Sep 15/73	
22-21-00	13	Aug 15/82	
22-21-00	14	Sep 15/73	
22-21-00	15/16	Aug 15/81	
22-21-00	17/18	May 15/85	
22-21-00	19	Sep 15/79	
22-21-00	20	Sep 15/79	
22-21-00	21/22	Sep 15/79	
22-21-00	101	Mar 15/81	
22-21-00	102	Mar 15/81	
22-21-00	103	Mar 15/81	
22-21-00	104	Mar 15/81	
22-21-00	105	Mar 15/81	
22-21-00	106	Mar 15/81	
22-21-00	107	Mar 15/81	
22-21-00	108	Mar 15/81	
22-21-00	109	Mar 15/81	
22-21-00	110	Mar 15/81	
22-21-00	111	Aug 15/82	
22-21-00	112	Mar 15/81	
22-21-00	113	Mar 15/81	
22-21-00	114	Mar 15/81	
22-21-00	115	Mar 15/81	
22-21-00	116	Aug 15/82	
22-21-00	117	Mar 15/81	
22-21-00	118	Mar 15/81	
22-21-00	119	Mar 15/81	
22-21-00	120	Mar 15/81	
22-21-00	121	May 15/82	
22-21-00	122	Mar 15/81	
22-21-00	123	Aug 15/82	
22-21-00	124	Mar 15/81	
22-21-00	125	Aug 15/82	
22-21-00	126	Aug 15/82	
22-21-00	127	Aug 15/82	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
22-21-00	128	Aug 15/82	
22-21-00	129	Aug 15/82	
22-21-00	130	Aug 15/82	
22-21-00	131	Aug 15/82	
22-21-00	132	Aug 15/82	
22-21-00	133	Aug 15/82	
22-21-00	134	Aug 15/82	
22-21-00	135	Aug 15/82	
22-21-00	136	Aug 15/82	
22-21-00	137	Aug 15/82	
22-21-00	138	Aug 15/82	
22-21-00	139	Aug 15/82	
22-21-00	140	Aug 15/82	
22-21-00	141	Aug 15/82	
22-21-00	142	Aug 15/82	
22-21-00	143	Aug 15/82	
22-21-00	144	Aug 15/82	
22-21-00	145	Aug 15/82	
22-21-00	146	Aug 15/82	
22-21-00	147/148	Aug 15/82	
22-21-00	149/150	Aug 15/82	
22-21-00	151/152	Aug 15/82	
22-21-00	153/154	Aug 15/82	
22-21-00	155/156	Aug 15/82	
22-21-00	157/158	Aug 15/82	
22-21-00	159/160	Aug 15/82	
22-21-00	501	Aug 15/81	
22-21-00	502	Aug 15/81	
22-21-00	503	May 15/85	
22-21-00	504	May 15/85	
22-21-01	401	May 15/86	
22-21-01	402	May 15/86	
22-21-01	403/404	Aug 15/81	
22-21-01	501	May 15/78	
22-21-01	502	May 15/78	
22-21-01	503/504	Oct 1/72	
22-21-02	401	Nov 15/88	
22-21-02	402	Nov 15/88	
22-21-02	403/404	Aug 15/81	
22-21-02	501	Aug 15/82	
22-21-02	502	Aug 15/82	
22-21-02	503/504	Aug 15/82	
22-30-00	1/2	Jul 15/84	
22-31-00	1	Feb 15/78	
22-31-00	2	Sep 15/73	
22-31-00	3/4	Sep 15/73	
22-31-00	5/6	Sep 15/73	
22-31-00	7/8	Nov 15/75	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
22-31-00	9	Sep 15/73	
22-31-00	10	Feb 15/78	
22-31-00	11	Nov 15/84	
22-31-00	12	Jul 15/84	
22-31-00	13/14	Nov 15/84	
22-31-00	15/16	Nov 15/84	
22-31-00	17	Jul 15/84	
22-31-00	18	Jul 15/84	
22-31-00	19	Nov 15/84	
22-31-00	20	May 15/89	
22-31-00	21	Nov 15/84	
22-31-00	22	Nov 15/84	
22-31-00	23	Nov 15/84	
22-31-00	24	Mar 15/91	
22-31-00	25	Mar 15/91	
22-31-00	26	Nov 15/84	
22-31-00	27	Mar 15/91	
22-31-00	28	May 15/89	
22-31-00	29	Nov 15/84	
22-31-00	30	Nov 15/84	
22-31-00	31	Nov 15/84	
22-31-00	32	Nov 15/84	
22-31-00	33	Nov 15/84	
22-31-00	34	Nov 15/84	
22-31-00	35	Nov 15/84	
22-31-00	36	Nov 15/84	
22-31-00	37	Nov 15/84	
22-31-00	38	Nov 15/84	
22-31-00	39/40	Nov 15/84	
22-31-00	101	Nov 15/84	
22-31-00	102	Nov 15/84	
22-31-00	103	Nov 15/84	
22-31-00	104	Nov 15/84	
22-31-00	105	Nov 15/84	
22-31-00	106	Nov 15/84	
22-31-00	107	Mar 15/81	
22-31-00	108	Nov 15/89	
22-31-00	109	Nov 15/89	
22-31-00	110	Nov 15/84	
22-31-00	111	Nov 15/84	
22-31-00	112	Nov 15/84	
22-31-00	113	Nov 15/84	
22-31-00	114	Nov 15/84	
22-31-00	115	Nov 15/84	
22-31-00	116	Nov 15/84	
22-31-00	117	Nov 15/84	
22-31-00	118	Nov 15/84	
22-31-00	119	Nov 15/84	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
22-31-00	120	Nov 15/84	
22-31-00	121	Nov 15/84	
22-31-00	122	May 15/85	
22-31-00	123	Nov 15/89	
22-31-00	124	Nov 15/84	
22-31-00	125	Nov 15/84	
22-31-00	126	Nov 15/84	
22-31-00	127	Nov 15/84	
22-31-00	128	Nov 15/84	
22-31-00	129	Nov 15/84	
22-31-00	130	Nov 15/84	
22-31-00	131	Nov 15/84	
22-31-00	132	Nov 15/84	
22-31-00	133	Nov 15/89	
22-31-00	134	Mar 15/81	
22-31-00	135	Mar 15/81	
22-31-00	136	Mar 15/81	
22-31-00	137	May 15/89	
22-31-00	138	May 15/89	
22-31-00	139	May 15/89	
22-31-00	140	Nov 15/87	
22-31-00	141	May 15/89	
22-31-00	142	Nov 15/87	
22-31-00	143	Nov 15/87	
22-31-00	144	May 15/89	
22-31-00	145	May 15/89	
22-31-00	146	May 15/89	
22-31-00	147	May 15/89	
22-31-00	148	May 15/89	
22-31-00	149	May 15/89	
22-31-00	150	Nov 15/87	
22-31-00	151	Nov 15/87	
22-31-00	152	Nov 15/87	
22-31-00	153	Nov 15/87	
22-31-00	154	Nov 15/87	
22-31-00	155	May 15/89	
22-31-00	156	Nov 15/87	
22-31-00	157	May 15/89	
22-31-00	158	Nov 15/87	
22-31-00	159	May 15/89	
22-31-00	160	Nov 15/87	
22-31-00	161/162	Nov 15/84	
22-31-00	163/164	Nov 15/84	
22-31-00	165/166	Nov 15/84	
22-31-00	167/168	Mar 15/91	
22-31-00	169/170	Mar 15/91	
22-31-00	171/172	Mar 15/91	
22-31-00	173/174	Mar 15/91	
22-31-00	175/176	Mar 15/91	
22-31-00	177/178	Mar 15/91	
22-31-00	179/180	Mar 15/91	
22-31-00	181/182	Mar 15/91	
22-31-00	183/184	Mar 15/91	
22-31-00	185/186	Mar 15/91	
22-31-00	201/202	Aug 15/81	
22-31-00	501	May 15/82	1
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22-31-00	504	Jun 15/94	1
22-31-00	505	Jun 15/94	1
22-31-00	506	Jun 15/94	1
22-31-00	501	May 15/82	2
22-31-00	502	May 15/82	2
22-31-00	503	May 15/82	2
22-31-00	504	Jun 15/94	2
22-31-00	505	Jun 15/94	2
22-31-00	506	Jun 15/94	2
22-31-00	507/508	Jun 15/94	2
22-31-01	401	Feb 15/79	
22-31-01	402	Dec 1/71	
22-31-01	501	May 15/78	
22-31-01	502	Feb 15/82	
22-31-01	503/504	Jun 15/94	
22-31-02	401	Jul 15/84	
22-31-02	402	Jul 15/84	
22-31-02	403/404	Mar 1/72	
22-31-02	405	Jun 15/93	
22-31-02	406	Jun 15/93	
22-31-03	401/402	Aug 15/76	
22-31-03	501	Nov 15/73	
22-31-03	502	Aug 15/81	
22-31-03	503/504	Jun 15/94	
22-31-04	401	Mar 15/80	
22-31-04	402	Dec 1/71	
22-31-05	401	May 15/82	
22-31-05	402	May 15/82	
22-31-05	403/404	May 15/82	
22-31-06	401	Nov 15/84	
22-31-06	402	Aug 15/81	
22-31-06	403	Nov 15/84	
22-31-06	404	Sep 15/73	
22-31-06	501	May 15/89	
22-31-06	502	May 15/89	
22-31-07	401	Mar 15/80	
22-31-07	402	Nov 15/88	
22-31-07	403	May 15/90	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE	CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
22-31-07	404	Feb 15/74					
22-31-08	401	May 15/82					
22-31-08	402	May 15/82					
22-31-08	403/404	May 15/82					
22-31-08	501	Jun 15/80					
22-31-08	502	May 15/82					
22-31-08	503/504	May 15/82					
22-31-09	401	May 15/82					
22-31-09	402	May 15/82					
22-31-09	403	Mar 1/72					
22-31-09	404	Apr 15/73					

CHAPTER 22

AUTO FLIGHT

TABLE OF CONTENTS

Subject	Chapter Section Subject	Page	Effectivity
AUTO FLIGHT ABBREVIATIONS	22-ABBR		
R Abbreviations		101	ALL

R	Subject	Chapter Section Subject	Page	Effec-tivity
R	AUTO FLIGHT	22-00-00		
R	Description and Operation		1	ALL
R	Fault Isolation		101	ALL
R	Adjustment/Test		501	ALL
R	Inspection/Check		601	ALL
R	PANELS, EDGE-LIGHTED - AFCS			
R	Relamping Procedure (Ref. 33-14-01)			
R	FLIGHT DIRECTOR SYSTEM - AUTOPILOT	22-01-00		
R	Adjustment/Test		501	ALL
R	LAMPS AND ANNUNCIATORS - AFCS	22-02-01		
R	Fault Isolation		101	ALL
R	Adjustment/Test		501	ALL
R	FIM SYSTEM - AFCS	22-09-00		
R	Description and Operation		1	ALL

Subject	Chapter Section Subject	Page	Effectivity
AUTOPILOT	22-10-00		
Description and Operation		1	ALL
PANEL - APFDS ENGAGE	22-10-01		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
PANEL - NAVIGATION MODE-SELECT	22-10-02		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
PANEL - HEADING/PITCH MODE COMMAND	22-10-03		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
INDICATOR - AFCS MODES ANNUNCIATOR	22-10-05		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
INDICATOR - AFCS WARNING	22-10-06		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
PANEL - FCES CONTROL	22-10-07		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
PANEL - FLIGHT CONTROL	22-10-09		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL

Subject	Chapter Section Subject	Page	Effectivity
AUTOPILOT (CONT)	22-10-00		
UNIT - AFCS/MLG ACCESSORY	22-10-11		
Fault Isolation		101	ALL
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
UNIT - FLIGHT CONTROL AUXILIARY	22-10-12		
Maintenance Practices		201	ALL
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
SWITCH - AUTOPILOT DISCONNECT	22-10-21		
Removal/Installation		401	ALL
SWITCH - CONTROL WHEEL GO-AROUND	22-10-22		
Removal/Installation		401	ALL
GENERATOR - ELECTRICAL PITCH TRIM	22-10-23		
Removal/Installation		401	ALL
CABLE ASSEMBLY - CONTROL WHEEL	22-10-28		
Removal/Installation		401	ALL
FD BASIC MODE	22-10-31		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
CWS/CMD MODE - AUTOPILOT	22-10-33		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
CWS/CMD MODE - AUTOPILOT B	22-10-35		
Adjustment/Test		501	ALL
AUTOPILOT - FLIGHT DIRECTOR PITCH SYSTEM	22-11-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL

Subject	Chapter Section Subject	Page	Effectivity
AUTOPILOT (CONT)	22-10-00		
COMPUTER - PITCH	22-11-01		
Removal/Installation		401	ALL
UNIT - NORMAL ACCELEROMETER	22-11-02		
Removal/Installation		401	ALL
PANEL - ALTITUDE SELECT	22-11-03		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
SERVO - STABILIZER AUTOPILOT CONTROL	22-11-05		
Removal/Installation		401	ALL
FILTER ELEMENT - STABILIZER AUTOPILOT CONTROL SERVO	22-11-06		
Removal/Installation		401	ALL
VALVE - AUTOPILOT SERVO SOLENOID SHUTOFF	22-11-07		
Removal/Installation		401	ALL
VALVE - STABILIZER AUTOPILOT ELECTROHYDRAULIC SERVO	22-11-08		
Removal/Installation		401	ALL
SWITCH - STABILIZER AUTOPILOT SERVO PRESSURE	22-11-09		
Removal/Installation		401	ALL
VALVE - STABILIZER AUTOPILOT SERVO CASE RELIEF	22-11-10		
Removal/Installation		401	ALL
FD VERTICAL SPEED MODE	22-11-31		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
FD ALTITUDE HOLD MODE	22-11-33		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
FD ALTITUDE SELECT MODE	22-11-35		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
FD IAS HOLD MODE	22-11-37		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
FD MACH HOLD MODE	22-11-39		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
TURBULENCE MODE	22-11-43		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL

Subject	Chapter Section Subject	Page	Effectivity
AUTOPILOT (CONT)	22-10-00		
APFDS MODES OF OPERATION	22-12-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
Maintenance Practices		201	ALL
FD LOCALIZER MODE	22-12-19		
Fault Isolation		101	ALL
FD APPROACH MODE	22-12-21		
Fault Isolation		101	ALL
TAKEOFF MODE	22-12-29		
Fault Isolation		101	ALL
DUAL A/L NOT AVAIL (DANA)	22-12-37		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
GO-AROUND MODE	22-12-39		
Fault Isolation		101	ALL
ROLL SYSTEM - AUTOPILOT FLIGHT DIRECTOR	22-13-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL

Subject	Chapter Section Subject	Page	Effectivity
AUTOPILOT (CONT)	22-10-00		
ROLL COMPUTER	22-13-01		
Removal/Installation		401	ALL
UNIT - LATERAL ACCELEROMETER	22-13-02		
Maintenance Practices		201	ALL
Removal/Installation		401	ALL
TRANSDUCER, DUAL POSITION - AILERON	22-13-03		
Maintenance Practices		201	ALL
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
FD HEADING SELECT MODE	22-13-31		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
FD VOR MODE	22-13-35		
Fault Isolation		101	ALL
AUTOLAND MODE (TOTAL SEQUENCE)	22-14-31		
Fault Isolation		101	ALL
Maintenance Practices		201	ALL
Adjustment/Test		501	ALL
AUTOLAND MODE (PRE-TRACK AND TRACK)	22-14-33		
Fault Isolation		101	ALL
AUTOLAND TRACK MODE (ALIGN, FLARE, AND ROLLOUT)	22-14-35		
Fault Isolation		101	ALL
YAW STABILITY AUGMENTATION SYSTEM	22-15-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
Adjustment/Test		501	ALL

Subject	Chapter Section Subject	Page	Effectivity
AUTOPILOT (CONT)	22-10-00		
YAW COMPUTER	22-15-01		
Maintenance Practices		201	ALL
Removal/Installation		401	ALL
GYRO - YAW RATE	22-15-02		
Removal/Installation		401	ALL
TRANSDUCER - RUDDER DUAL POSITION	22-15-03		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
FLIGHT CONTROL ELECTRONICS SYSTEM	22-17-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
Maintenance Practices		201	ALL
Adjustment/Test		501	ALL
FCES COMPUTER	22-17-01		
Removal/Installation		401	ALL
PANEL - PFCS MONITOR/CONTROL	22-17-02		
Maintenance Practices		201	ALL
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
SWITCH - FLAP LEVER POSITION	22-17-03		
Removal/Installation		401	ALL
SYSTEM - STALL WARN	22-17-05		
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
SYSTEM - ALTITUDE ALERT	22-17-06		
Fault Isolation		101	ALL

	Subject	Chapter Section Subject	Page	Effectivity
R	AUTOPILOT (CONT)	22-10-00		
R	DIRECT LIFT CONTROL/			
R	AUTOMATIC GROUND SPOILER	22-17-07		
R	Fault Isolation		101	ALL
R	Adjustment/Test		501	ALL
CR	DIRECT LIFT CONTROL/AUTO GROUND	22-17-08		
CR	SPEED BRAKE			
CR	Troubleshooting		501	ALL
R	PFCS MONITORING	22-17-09		
R	Fault Isolation		101	ALL
R	STICK SHAKER	22-17-16		
R	Removal/Installation		401	ALL
R	TRIM AUGMENTATION SYSTEM	22-18-00		
R	Description and Operation		1	ALL
R	Fault Isolation		101	ALL
R	Adjustment/Test		501	ALL
R	COMPUTER - TRIM AUGMENTATION	22-18-01		
R	Removal/Installation		401	ALL
R	MOTOR - ELECTRIC TRIM	22-18-10		
R	Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effectivity
SPEED ATTITUDE CORRECTION	22-20-00		
Description and Operation		1	ALL
MACH TRIM AND FEEL SYSTEMS	22-21-00		
Description and Operation		1	ALL
Fault Isolation		101	ALL
Adjustment/Test		501	ALL
MOTOR - MACH TRIM	22-21-01		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
MOTOR - MACH FEEL SCHEDULE	22-21-02		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL

	Subject	Chapter Section Subject	Page	Effectivity
R	AUTOTHROTTLE	22-30-00		
R	Description and Operation		1	ALL
R	SYSTEM - SPEED CONTROL	22-31-00		
R	Description and Operation		1	ALL
R	Fault Isolation		101	ALL
R	Maintenance Practices		201	ALL
CR	Adjustment/Test		501	CONFIG 1 AIRCRAFT WITH ANALOG CENTRAL AIR DATA COMPUTER
CR	Adjustment/Test		501	CONFIG 2 AIRCRAFT WITH DIGITAL CENTRAL AIR DATA COMPUTER
R	SERVO - AUTOTHROTTLE	22-31-01		
R	Removal/Installation		401	ALL
R	Adjustment/Test		501	ALL
R	ASSEMBLY - AUTOTHROTTLE CLUTCH	22-31-02		
R	Removal/Installation		401	ALL
R	PANEL - THRUST SELECT	22-31-03		
R	Removal/Installation		401	ALL
R	Adjustment/Test		501	ALL
R	GEARBOX - AUTOTHROTTLE SERVO	22-31-04		
R	Removal/Installation		401	ALL

Subject	Chapter Section Subject	Page	Effectivity
AUTOTHROTTLE (CONT)	22-30-00		
UNIT - LONGITUDINAL ACCELEROMETER	22-31-05		
Removal/Installation		401	ALL
SENSOR - ANGLE-OF-ATTACK	22-31-06		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
COMPUTER - SPEED CONTROL	22-31-07		
Removal/Installation		401	ALL
SWITCH - AUTOTHROTTLE DISENGAGE	22-31-08		
Removal/Installation		401	ALL
Adjustment/Test		501	ALL
SWITCH - POWER CONTROL LEVER	22-31-09		
Removal/Installation		401	ALL

R AUTO FLIGHT

R ABBREVIATIONS

R 1. General

R Auto flight abbreviations are shown in the definitions for logic
R terms table. The definitions for logic terms table lists the
R mnemonic definitions for logic terms used in auto flight
R schematics which are not self explanatory. The nomenclature A
R and B added to mnemonic symbol refers to that logic generated in
R Channel A or B respectively. "This side" nomenclature is
R synonymous with computer "1" and "other side" with computer
R The table also lists the source of the logic terms so that it
R can be determined how the logic is developed.

2. Definitions for Logic Terms

MNEMONIC	SOURCE	DEFINITION
AADF	22-31-00, SCHEM 4	Angle of Attack Averaging Defeat
AALS	22-11-00, SCHEM 5, o	Altitude Acquire Level Switch
AC	22-11-00, SCHEM 14	Altitude Capture
ACLOR	22-13-00, SCHEM 10	Aileron Command Limit Override
ACLS	22-11-00, SCHEM 5, 6	Altitude Capture Level Switch
ACV	22-11-00, SCHEM 14	Altitude Capture Validity
ADC	----	Air Data Computer
ADI	----	Altitude Director Indicator
ADIF	22-11-00, SCHEM 8	ADI Flag Inhibit
AF	22-15-00, SCHEM 6	Align Fader Switch Logic
AGSB	22-17-00, SCHEM 10	Auto Ground Speed Brake
AHE	22-11-00, SCHEM 14	Altitude Hold Engaged
AHG	22-11-00, SCHEM 11	Altitude Hold Good
AHS	22-11-00, SCHEM 14	Altitude Hold Selected
AL	22-13-00, SCHEM 7	AUTOLAND
A/L ILS	22-13-00, SCHEM 9	ILS Freq. - This Side
ALIM	22-15-00, SCHEM 6	Align Mode (Runway Yaw Steering)
ALTRK	22-11-00, SCHEM 16 22-13-00, SCHEM 8, 9	Approach Land Track
ALT-T	22-31-00, SCHEM 5	Takeoff/Go Around Altitude Trip
ALV	22-11-00, SCHEM 17	AUTOLAND Validity
AN	22-11-00, SCHEM 5, 6, 7	Normal Acceleration
ANN		Annunciator
AOA VALID	22-17-00, SCHEM 3	Angle of Attack Valid
APCMD	22-11-00, SCHEM 9	Autopilot Engaged in CMD
APE	22-11-00, SCHEM 9	Autopilot Engaged
APENG	22-13-00, SCHEM 10	Either Autopilot Servos On
APFE	22-11-00, SCHEM 9	Autopilot First Engaged
APNFF	22-13-00, SCHEM 11	Autopilot No First Failure
APPD	22-11-00, SCHEM 15	Approach Disconnect
APPE	22-13-00, SCHEM 7	Approach Engage
APPLE	22-11-00, SCHEM 15, 22-13-00, SCHEM 7	Approach Land Engaged (ARMED)
APSE	22-13-00, SCHEM 10	Autopilot Servo Engaged
ASAE	22-11-00, SCHEM 14	Altitude Select Arm Engaged
ASAERST	22-11-00, SCHEM 14	Altitude Select Arm Engaged Reset
ASAS	22-11-00, SCHEM 14	Altitude Select Arm Selected
ASE	22-31-00, SCHEM 2	Airspeed Error
ASM	22-31-00, SCHEM 6	Airspeed Mode (Auto Throttle)

EFFECTIVITY: ALL

001B

MNEMONIC	SOURCE	DEFINITION
AT	22-31-00	Auto Throttle
ATE	22-31-00, SCHEM 6	Auto Throttle Engaged
AT ENG	22-31-00, SCHEM 6	Auto Throttle Engaged
ATI	22-11-00, SCHEM 13	Auto Throttle Inhibit
AT INTERLOCK	22-31-00, SCHEM 7	Auto Throttle Interlock Logic
ATOR	22-31-00, SCHEM 9	Auto Throttle Override
ATSD	22-31-00, SCHEM 6	Auto Throttle Servo Disconnect
ATV	22-18-00, SCHEM 3	Auto Trim Valid
AV	22-11-00, SCHEM 11	Altitude Hold Validity
BB	22-11-00, SCHEM 8	Bar Bias
BED	22-11-00, SCHEM 18	Beam Error Detector, Glideslope
BHE	22-13-00, SCHEM 8	Bank Hold Mode Engaged
BLSA	22-11-00, SCHEM 15	Beam Level Switch A (30 ua)
BLSB	22-11-00, SCHEM 15	Beam Level Switch B (15ua)
BT	22-11-00, SCHEM 12	Bogie (Truck) Tilt
C1	22-11-00, SCHEM 17	Channel 1 to 2 Comparator Crossfeed
C1	22-13-00, SCHEM 4	Computations A and B Good
C2	22-11-00, SCHEM 17	Channel 1 to 4 Comparator Crossfeed
C2	22-13-00, SCHEM 4	Computations A good -- this side and other side
C	22-11-00, SCHEM 4	Pitch Attitude Comparator
CØ	22-13-00, SCHEM 4	Roll Attitude Comparator
CADC	----	Central Air Data Computer
CAL	22-11-00, SCHEM 7, 22-13-00, SCHEM 4	AUTOLAND Comparator
CAL	22-15-00, SCHEM 4	Comparator Aileron Crossfeed
CAN	22-11-00, SCHEM 7, 22-13-00, SCHEM 5	Comparator, Accelerometer
CAP	22-13-00, SCHEM 8	Capture, Localizer
CAP INHIBIT	22-13-00, SCHEM 9	Capture Inhibit
CAPS	22-11-00, SCHEM 15	Glideslope Capture Select
CAP SENSOR	22-13-00, SCHEM 9	Capture Sensor Tripped
CASV	22-11-00, SCHEM 11	Computed Airspeed Validity
CAY	22-13-00, SCHEM 6	Lateral Accelerometer Comparator
CC	22-11-00, SCHEM 5, 6	FD CMD Modes Comparator
CC/1A	22-11-00, SCHEM 4	Channel 1 to 4 Comparator
CC/1B	22-11-00, SCHEM 4	Channel 1 to 2 Comparator
CCD	22-15-00, SCHEM 4	Comparator Course Data
CCWS	22-11-00, SCHEM 4, 22-13-00, SCHEM 4	Control Wheel Steering Comparator
CDC	22-11-00, SCHEM 16	DC Power Monitor
CD MON	22-15-00, SCHEM 4	Course Datum Monitor

MNEMONIC	SOURCE	DEFINITION
CF	22-13-00, SCHEM 4	Control Wheel Force Comparator Good
CFD	22-11-00, SCHEM 5, 6 22-13-00, SCHEM 5	Flight Director Comparator
CFD (YAW)	22-15-00, SCHEM 4	Comparator Faded Decrab
Ch•	22-11-00, SCHEM 5, 6	Vertical Rate Comparator
CMD	22-11-00, SCHEM 10	Either Autopilot in Command
CMDD	22-11-00, SCHEM 10	Command Hold Solenoid Drive
CMD HOLD	22-11-00, SCHEM 8	Command Hold
CMDHS	22-11-00, SCHEM 10	Command Hold Solenoid
CMDS	22-11-00, SCHEM 10	Command Switch Position
CPSH	22-11-00, SCHEM 9	Control Panel Solenoid High Side
CRO	22-13-00, SCHEM 6	Comparator Rollout
CS	22-15-00, SCHEM 3, 22-31-00, SCHEM 2	Comparator Servo Monitor
CS/1	22-11-00, SCHEM 4, 22-13-00, SCHEM 4, 22-15-00, SCHEM 3	Servo Monitor 1
CS/2	22-11-00, SCHEM 4, 22-13-00, SCHEM 4, 22-15-00, SCHEM 3	Servo Monitor 2
CT	22-31-00, SCHEM 2	Comparator Throttles
CTAS	22-11-00, SCHEM 5, 6	True Airspeed Comparator
CTG	22-11-00, SCHEM 4	Takeoff and Go Around Comparator
CWE	22-13-00, SCHEM 8	Control Wheel Mode Engaged
CWF1	22-13-00, SCHEM 4	Control Wheel Force Deadzone Detector Tripped
CWS	22-11-00, SCHEM 9	Control Wheel Steering
CWSD	22-11-00, SCHEM 9	Control Wheel Steering Solenoid Drive
CWSGT	22-11-00, SCHEM 5, 6	Control Wheel Force Greater Than Four Pounds
CWSHS	22-11-00, SCHEM 9	Control Wheel Steering Hold Solenoid
CWSS	22-11-00, SCHEM 9	Control Wheel Steering Switch Position
D	----	Delayed (Prefix, i.e. DRAV - DELAYED RAD ALT VALID)
DANA	22-13-00, SCHEM 11	Dual AUTOLAND Not Available
D APSE	22-13-00, SCHEM 10	Delayed Autopilot Servo Engaged
DCDC	22-13-00, SCHEM 12	Delayed Comparator DC
DLC ENG	22-17-00, SCHEM 11 & 12	Direct Lift Control Engaged
DLCNFF		Direct Lift Control No First Fail
DLCV	----	Direct Lift Control Validity

EFFECTIVITY: ALL

MNEMONIC	SOURCE	DEFINITION
DLGRV	22-11-00, SCHEM 15	Delayed and Latched Glide Path & Altitude Validities
D RA VALID	22-13-00, SCHEM 12, 22-15-00, SCHEM 6	Delayed Radio Altimeter Valid
D R/NAV VALID	22-13-00, SCHEM 13	Delayed Area Now Valid
D TAS VALID	22-13-00, SCHEM 8	Delayed True Airspeed Valid
EHV	----	Electro-Hydraulic Valve
ENG	----	Engaged
EQUAL	22-11-00, SCHEM 4, 22-13-00, SCHEM 4	Equalization Signal
F	22-11-00, SCHEM 15	Flare
FAIL	22-11-00, SCHEM 17	Executive Comparator Summation
FAIL MON	22-13-00, SCHEM 12	Executive Comparator Monitor
FCES	22-17-00	Flight Control Electronic System
FCES PM	22-17-00, SCHEM 1	FCES Power Monitor
FD	22-11-00, SCHEM 8, 22-13-00, SCHEM 13	Flight Director
FD CMD	22-11-00, SCHEM 5, 6	Flight Director Command
FDE	22-11-00, SCHEM 8, 22-13-00, SCHEM 13	Flight Director Engaged
FD PITCH CMD VALID	22-11-00, SCHEM 11	Flight Director Pitch Command Valid
FDPS	22-11-00, SCHEM 8	Flight Director Pitch Sync
FDS	22-11-00, SCHEM 8	Flight Director Selected
FD SIG ALCMD	22-11-00, SCHEM 7	Flight Director Signal AUTOLAND Command
FD SYNC	22-13-00, SCHEM 8	Flight Director Synchronize
FD TOE ANN	22-11-00, SCHEM 12	Flight Director Takeoff Engaged Annunciation
FD VALID	22-11-00, SCHEM 8	Flight Director Valid
FIM	----	Fault Isolation Monitor
FLR	22-31-00, SCHEM 4	Flare (Auto Throttle)
FORCE CMD REL	22-11-00, SCHEM 10	Force Command Release
FS	22-11-00, SCHEM 12	Flap Switch
F SYNC	22-11-00, SCHEM 14	Fast Synchronization
GA	----	Go Around
GAE	22-11-00, SCHEM 12	Go Around Engaged
GAS	22-11-00, SCHEM 12	Go Around Selected
GS	22-11-00, SCHEM 7	Glide Slope
GSC	22-11-00, SCHEM 15	Glide Slope Capture
GSC CAP	22-13-00, SCHEM 9	Glide Slope Capture
GSRV	22-11-00, SCHEM 15	Glide Slope Receiver Validity
GST	22-11-00, SCHEM 15	Glide Slope Track, Approach Land
GS TRK	22-13-00, SCHEM 9	Glide Slope Track
hº B	22-11-00, SCHEM 5	Barometric Vertical Speed

EFFECTIVITY: ALL

MNEMONIC	SOURCE	DEFINITION
h_o BLENDED	22-11-00, SCHEM 5	Barometric Vertical Rate (with acceleration)
HHE	22-13-00, SCHEM 8	Heading Hold Mode Engaged
HPE	22-11-00, SCHEM 9	High Pressure Hook Engage
HPHF	22-11-00, SCHEM 9	High Pressure Hook Fault
HPM	22-11-00, SCHEM 9	High Pressure Hook Monitor
HPMV	22-11-00, SCHEM 9	High Pressure Hook Monitor Valid
hR	22-11-00, SCHEM 7	Radio Altitude
HSE	22-13-00, SCHEM 8	Heading Select Mode Engaged
HTSA	22-11-00, SCHEM 7	Height Switch (1500 Ft)
HTSB	22-11-00, SCHEM 7	Height Switch (Flare)
IASE	22-11-00, SCHEM 13	Indicated Air Speed Hold Engaged
IASS	22-11-00, SCHEM 13	Indicated Air Speed Hold Selected
IAS SOL	22-11-00, SCHEM 13	IAS CADC Hold Clutch Drive
IAT	22-18-00, SCHEM 4	Inhibit Auto Trim
ILS FREQ	22-13-00, SCHEM 9	ILS/NAV Switch in ILS Position (this side)
LIMIT	22-11-00, SCHEM 17	Reference
LOC DEV	22-13-00, SCHEM 8	Localizer Deviation
LOCE	22-13-00, SCHEM 7	Localizer Mode Engaged
LOC ENABLE	22-13-00, SCHEM 7	Localizer Enable
LOC INST VALID	22-13-00, SCHEM 11	Localizer Valid
LOC VALID	22-13-00, SCHEM 9	Localizer Valid
LSLSB	22-11-00, SCHEM 15	Latched Beam Level Switch B
LSSW	22-13-00, SCHEM 10	Left Strut Switch (Air/Ground)
LVDT	22-11-00, SCHEM 4, 22-13-00, SCHEM 4, 22-15-00, SCHEM 3, 22-17-00, SCHEM 10, 22-18-00, SCHEM 2	Linear Voltage Displacement Transducer (Servo Mod Piston Position)
MBB	22-11-00, SCHEM 8	Mode Bar Bias
MCE	22-31-00, SCHEM 7	Motor Control Enable (Auto Throttle)
MED	22-11-00, SCHEM 12	Mode Engage Disable
MGS	22-11-00, SCHEM 12	Main Gear Switch (Stroke Limit)
MHE	22-11-00, SCHEM 13	Mach Hold Engaged
MHE SOL	22-11-00, SCHEM 13	Mach Hold CADC Clutch Drive
MHS	22-11-00, SCHEM 13	Mach Hold Select
MODE	22-11-00, SCHEM 14	Reference
MODE SEL	22-11-00, SCHEM 12	Mode Select
MV	22-11-00, SCHEM 11, 22-18-00, SCHEM 6	Mach Validity
NAM	22-11-00, SCHEM 9	Normal Accelerometer Monitor

MNEMONIC	SOURCE	DEFINITION
NAV ENABLE	22-13-00, SCHEM 9	Not ILS Frequency and Not OILS Frequency
ND	22-11-00, SCHEM 15	Nose Down
O or O/xxx	----	Used to signify signals from the other Computer in the System
OILS FREQ	22-13-00, SCHEM 9	ILS/NAV Switch in ILS position --other side
O/PFDV	22-11-00, SCHEM 8	Other Pitch Flight Director Valid
OS	22-13-00, SCHEM 9	Overstation
OSS	22-13-00, SCHEM 9	Overstation Sensor Tripped
P CAP	22-11-00, SCHEM 15	Partial Glide Slope Capture
P CMD V.	22-11-00, SCHEM 11	Pitch Command Valid
PFCS MON	22-17-00, SCHEM 9	Primary Flight Control System Monitor
PHD	22-11-00, SCHEM 9	Pitch Hook Disengaged
PHE	22-11-00, SCHEM 9	Pitch Hook Engaged
PHL	22-11-00, SCHEM 9	Pitch Hook Limit
PHS	22-11-00, SCHEM 4	Pitch Hook SYNC
P NAV VALID	22-13-00, SCHEM 12	Processed NAV Signal Valid
PNFF	22-11-00, SCHEM 17	Pitch (Computer) no First Failure
PRL	22-15-00, SCHEM 5	Parallel Rudder Logic
PRO CAL	22-11-00, SCHEM 17	Processed Comparator, AUTOLAND
PRST	22-11-00, SCHEM 12	Partial Reset
PSM	22-31-00, SCHEM 1	Power Supply Monitor
PT I	22-11-00, SCHEM 9	Pitch Trim Inhibit
RAV	22-11-00, SCHEM 11, 22-11-00, SCHEM 15, 22-13-00, SCHEM 5	Radio Altitude Valid
RC1	22-11-00, SCHEM 4	Rate Comparator (CHAN 1-CHAN-2)
RC2	22-11-00, SCHEM 4	Rate Comparator (CHAN 1-CHAN-4)
RCMDE	22-11-00, SCHEM 10	Roll Command Enable
RHE	22-15-00, SCHEM 5	Rudder Hook Engaged
RHK	22-15-00, SCHEM 5	Rudder Hook Monitor
RMP ENG	22-15-00, SCHEM 5	Rudder Mod Piston Engaged
R NAV	22-13-00, SCHEM 8	Area Navigation
R NAV RESET	22-13-00, SCHEM 7	Area Nav Reset
RO ALT	22-15-00, SCHEM 6	Rollout Altitude
ROM	22-15-00, SCHEM 6	Rollout Mode
RSE	22-11-00, SCHEM 9	Roll Servo Engaged
RSSW	22-13-00, SCHEM 10	Right Strut Switch (Air Ground)
RV	22-11-00, SCHEM 9, 22-13-00, SCHEM 10	Roll (Computer) Valid

EFFECTIVITY: ALL

001B

MNEMONIC	SOURCE	DEFINITION
S_1-S_2-S_3-S_4	22-11-00, SCHEM 4, 17	Voter Switches
SAS AC MON	22-15-00, SCHEM 2	YAW SAS AC Power Monitor
SAS DC MON	22-15-00, SCHEM 2	YAW SAS DC Power Monitor
SCSV	22-11-00, SCHEM 8	Takeoff/go Around Signal Valid From Speed Control System
SMV	22-11-00, SCHEM 11	Speed Mode Valid
SMM	22-31-00, SCHEM 4	Stall Margin Mode (Auto Throttle)
SOV	22-17-00, SCHEM 11, 12	Shutoff Valve (Electro-Hydraulic)
SPLR	22-17-00, SCHEM 8	Spoiler (FLT Controls)
SSW	22-13-00, SCHEM 10, 22-31-00, SCHEM 4	Strut Switch
SVS	22-11-00, SCHEM 10	SYNC Vertical Speed
TA	22-18-00	Trim Augmentation
TAPE	22-11-00, SCHEM 9	This Side Autopilot Engaged
TA PM	22-18-00, SCHEM 1	Trim Augmentation Power Monitor
TA PWR VALID	22-18-00, SCHEM 1	Trim Augmentation Power Valid
TAS	22-11-00, SCHEM 5, 22-11-00, SCHEM 6	True Airspeed
TAS V	22-11-00, SCHEM 11	True Airspeed Valid
TC	22-15-00, SCHEM 7	Turn Coordination Mode
TE	22-11-00, SCHEM 13	Turbulence (Mode) Engaged
TE ANN	22-11-00, SCHEM 13	Turbulence Engaged Annunciation
TOE	22-11-00, SCHEM 12,	Takeoff (Mode) Engaged
TOE ANN	22-11-00, SCHEM 12	Takeoff Engage Annunciation
TO/GA CMD	22-31-00, SCHEM 3	Takeoff/Go Around Command
TO/GA CP	22-31-00, SCHEM 3	Takeoff/Go Around Comparator
TO/GA VALID	22-31-00, SCHEM 8	Takeoff/Go Around Valid
TRIM V	22-11-00, SCHEM 9	Trim System Valid
TRK	22-11-00, SCHEM 15, 22-13-00, SCHEM 9	Glideslope Track and Approach
TS	22-11-00, SCHEM 13	Turbulence Select
TURB	22-11-00, SCHEM 13	Turbulence Mode
VGV	22-11-00, SCHEM 8	Vertical Gyro Valid
VOR	22-13-00, SCHEM 8	VHF Omni Range
VORE	22-13-00, SCHEM 7	VHF Omni Range (Mode) Engaged
VSE	22-11-00, SCHEM 13	Vertical Speed (Mode) Engaged
V/S ERROR	22-11-00, SCHEM 5, 22-11-00, SCHEM 6	Vertical Speed Error
VSS	22-11-00, SCHEM 13	Vertical Speed Select
YAW CAT III	22-15-00, SCHEM 7	Yaw Category III Valid

EFFECTIVITY: ALL

MNEMONIC	SOURCE	DEFINITION
YNFF	22-15-00, SCHEM 7	Yaw (Computer) No First Failure
YTOM	22-15-00, SCHEM 6	Yaw Take Off Mode
Ø>3°	22-13-00, SCHEM 4	Roll Attitude Sensor Greater than 3 Degrees
ØC< 5°	22-13-00, SCHEM 5	Roll Attitude Sensor Comparator less than 5°

CHAPTER 22-AUTO FLIGHT

TABLE OF CONTENTS

Subject	Chapter/ Section Subject	Page
FAULT CODE DIAGRAMS		1
FAULT CODE INDEX		1
AUTO FLIGHT	22-00-00	
General		101
Fault Isolation Using FIM		101
AFCS Fault Isolation Breakdown Table 102		112
Fault Isolation/Identification		113/114
AFCS Interconnect Cabling Block Diagram		115/116
AFCS Primary Power Distribution, Pilots Overhead CB Panel, CB1 Schematic		127/128
AFCS Primary Power Distribution, FE/SO Overhead CB Panel, CB2 and Aft CB Panel CB3 Schematic		131/132
AFCS Primary Power Distribution, FE/SO Overhead CB Panel, CB2 and Aft CB Panel, CB3 Schematic		133/134
AFCS Control Panel Lamp Test and Dimming Schematic		135/136
AFCS Schematic Home Diagram		141/142
APFDS Schematic Symbols		146
Flight Controls Hydraulic Power Distribution Schematic		149/150
Captains Control Wheel Schematic		153/154
First Officers Control Wheel Schematic		155/156
AFCS Mode Priority and Mode Compatibility Matrix		157/158
AFCS LAMPS AND ANNUNCIATORS	22-02-01	
General		101
Fault Isolation Identification		101
Component Location Index		104
Component Locator Diagram		105

Subject	Chapter/ Section Subject	Page
AFCS LAMPS AND ANNUNCIATORS (CONT)	22-02-01	
AFCS Modes Annunciator Fault Isolation		106
AFCS Warning Indicator Fault Isolation		108
AFCS Warning Indicator Simplified Schematic		111/112
AFCS/MLG ACCESSORY UNIT	22-10-11	
General		101
Equipment and Materials		101
Referenced Procedures		101
Fault Isolation Identification		102
Component Location Index		103
Component Locator Diagram		104
Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables		111
R AFCS/MLG Accessory Unit T-Cable Voltages R Measurements		119/120
AFCS/MLG Accessory Unit Interface Schematic		121/122
FD BASIC MODE	22-10-31	
General		101
Fault Isolation Identification		101
Component Location Index		104
Component Locator Diagram		105
FD Basic Mode Fault Matrix		107
FD Turned-Off Faults		109
FD Turned off Faults		111
FD Basic Mode Faults		112
FD Basic Modes Faults		120
FD Basic Mode Faults		121
FD Basic Mode Logic		127/128
FD Basic Mode Signal Flow		129/130
AUTOPILOT CWS/CMD MODE	22-10-33	
General		101
Fault Isolation Identification		101
Component Location Index		104
Component Locator Diagram		106
Autopilot CWS/CMD Mode Fault Matrix		111
Autopilot Locked-Off Faults		117

Subject	Chapter/ Section Subject	Page
AUTOPILOT CWS/CMD MODE (CONT)	22-10-33	
Locked-Off Faults		126
R Autopilot Locked-Off Faults		127
Autopilot Engage Logic Simplified Schematic		129/130
Autopilot Will Not Remain Engaged Faults		133
Autopilot CWS Signal Flow Simplified Schematic		149/150
Autopilot "CWS" Cruise Mode Faults		151
Autopilot Porpoising Faults		167
Control Column Buzz with AP Turned-on Faults		169/170
AUTOPILOT - FLIGHT DIRECTOR PITCH SYSTEM	22-11-00	
Fault Isolation Identification		101
Pitch System Schematic Locator		103/104
Pitch 26 VAC Secondary Power Distribution Schematic		105/106
Pitch DC Secondary Power Distribution Schematic		107/108
Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode Signal Flow Schematic		109/110
Pitch System No. 1 CWS/CRUISE Mode Signal Flow and FD Switching Schematic		113/114
Pitch System No. 2 CWS/CRUISE Mode Signal Flow Schematic		117/118
Pitch Systems No. 1 and No. 2 ALTRK Mode Signal Flow Schematic		121/122
FD Mode Engage Logic and FD Switching Schematic		123/124
CWS Mode Engage Logic Schematic		127/128
CMD Mode Engage Logic Schematic		133/134
Pitch Command Valid Logic Schematic		135/136
Takeoff/Go-Around Modes Engage Logic Schematic		137/138
Turbulence, Vertical Speed, Indicated Air Speed and Mach Hold Engage Logic Schematic		141/142
Turbulence, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic Schematic		143/144
Altitude Arm, Capture, and Hold Mode Engage Logic Schematic		145/146

Subject	Chapter/ Section Subject	Page
AUTOPILOT - FLIGHT DIRECTOR PITCH SYSTEM (CONT)	22-11-00	
Glideslope Capture, Track, Approach Land, and Flare Engage Logic Schematic		149/150
Pitch FIM Schematic		153/154
Pitch Computer No First Fail and Pitch A/L Available Schematic		157/158
FD VERTICAL SPEED MODE	22-11-31	
General		101
Fault Isolation Identification		101
Component Location Index		104
Component Locator Diagram		105
FD VS Mode Fault Matrix		106
FD VS Mode Faults		107
FD VS Mode Simplified Schematic		117/118
FD ALTITUDE HOLD MODE	22-11-33	
General		101
Fault Isolation Identification		101
Component Location Index		104
FD Altitude Hold Mode Fault Identification		105
FD Altitude Hold Mode Fault Matrix		106
FD Altitude Hold Mode Faults		107
FD Altitude Hold Mode Simplified Schematic		115/116
FD ALTITUDE SELECT MODE	22-11-35	
General		101
Fault Isolation Identification		101
Component Location Index		103
Component Locator Diagram		104
FD Altitude Select Mode Fault Matrix		105
FD Altitude Select Mode Faults		107
Altitude Select Mode Simplified Schematic		115/116
FD Altitude Select Mode Simplified Schematic		117/118

Subject	Chapter/ Section Subject	Page
FD IAS HOLD MODE	22-11-37	
General		101
Fault Isolation Identification		101
Component Location Index		103
Component Locator Diagram		104
FD IAS Hold Mode Fault Matrix		105
FD IAS Hold Mode Faults		106
FD IAS Hold Mode Simplified Schematic		113/114
FD MACH HOLD MODE	22-11-39	
General		101
Fault Isolation Identification		101
Component Location Index		103
Component Locator Diagram		104
FD MACH Hold Mode Fault Matrix		105
FD MACH Hold Mode Faults		106
FD MACH Hold Mode Fault		109
FD MACH Hold Mode Faults		110
FD MACH Hold Simplified Schematic		113/114
TURBULENCE MODE	22-11-43	
General		101
Fault Isolation Identification		101
Component Location Index		103
Component Locator Diagram		104
Turbulence Mode Fault Matrix		105
Turbulence Mode Faults		106
Autopilot Turbulence Mode Simplified Schematic		109/110
AFCS MODES OF OPERATION	22-12-00	
General		101
FD LOCALIZER MODE	22-12-19	
General		101
Equipment and Materials		101
Referenced Procedures		101
Component Location Index		102
FD Localizer Mode Component Locator Diagra		103

Subject	Chapter/ Section Subject	Page
FD LOCALIZER MODE (CONT)	22-12-19	
Fault Detection Test		104
Fault Isolation Identification		106
FD APPROACH MODE	22-12-21	
General		101
Equipment and Materials		101
Referenced Procedures		101
Fault Detection Test		102
Component Location Index		103
Component Locator Diagram		104
Fault Isolation		111
TAKEOFF MODE	22-12-29	
General		101
Equipment and Materials		101
Referenced Procedures		101
Fault Detection Test		101
Component Location Index		102
Component Locator Diagram		103
Speed Control System Fault Problem		105
Fault Isolation		114
DUAL A/L NOT AVAIL (DANA)	22-12-37	
General		101
Fault Isolation Identification		101
Component Location Index		103
Component Locator Diagram		104
Component Location Diagram		107
DANA Light Fault Matrix		108
Hard DANA Faults		112
Soft DANA Faults		124
GO AROUND MODE	22-12-39	
General		101
Equipment and Materials		101
Referenced Procedures		101
Component Location Index		102
Component Locator Diagram		103
Fault Detection Test		104
Speed Control System Fault Problem		105

Subject	Chapter/ Section Subject	Page
GO AROUND MODE (CONT)	22-12-39	
Fault Isolation		115
AUTOPILOT-FLIGHT DIRECTOR ROLL SYSTEM	22-13-00	
Fault Isolation/Identification		101
Roll System Schematic Locator		103/104
Roll 26 VAC Secondary Power Distribution Schematic		105/106
Roll DC Secondary Power Distribution Schematic		107/108
Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic		109/110
Roll System No. 1 and No. 2 Basic Mode Signal Flow Schematic		111/112
R Roll Systems No. 1 and No. 2 Basic Mode		
R Signal Flow Schematic		113/114
Roll System No. 1 and No. 2 CMD Mode Signal Flow Schematic		119/120
Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic		121/122
Roll Systems No. 1 and No. 2 AUTOLAND Mode Signal Flow Schematic		125/126
A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic		129/130
HDG SEL, HDG HOLD, Capture, A/L TRK-B and R-NAV Mode Engage (Exclusive Mode) Logic Schematic		133/134
HDG SEL, HDG Hold, Capture, A/L TRK-B and R-NAV Mode Engage (Exclusive Mode) Logic Schematic		135/136
A/L TRK A, TRK 1, VOR/LOC Capture, OS and LOC TRK Mode Engage Logic Schematic		137/138
Roll Servo Engage/Valid and Roll Valid Logic Schematic		141/142
A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning		145/146
A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic		147/148
Roll Voter Switching and Valid Processing Logic Schematic		151/152
Roll Command and FD Valid Logic Schematic		153/154
Roll Command Enable and FD Valid Logic Schematic		155/156
Roll FIM Schematic		157/158

Subject	Chapter/ Section Subject	Page
FD HEADING SELECT MODE	22-13-31	
General		101
Fault Isolation Identification		101
Component Location Index		103
R Component Locator Diagram		104
FD Heading Select Mode Fault Identification		105
FD Heading Select Mode Faults		106
FD Heading Select Mode Simplified Schematic		115/116
FD NAV (VOR) MODE	22-13-35	
General		101
Equipment and Materials		101
Reference Procedures		101
Component Location Index		102
Component Locator Diagram		103
Fault Detection Test		104
Fault Isolation		108
AUTOLAND MODE (TOTAL SEQUENCE)	22-14-31	
General		101
Fault Isolation Identification		101
Component Location Index		103
R Component Locator Diagram		104
AUTOLAND Fault Matrix		107
A/L Mode Engagement Faults		119
A/L LOC Capture Mode Faults		125
A/L GS Capture Mode Faults		130
A/L Track Mode Faults		134
A/L ALIGN Mode Faults		153
A/L FLARE Mode Faults		158
A/L ROLLOUT Mode Faults		160
A/L Touchdown to Ramp Faults		165
AUTOLAND MODE (PRE-TRACK AND TRACK)	22-14-33	
General		101
Equipment and Materials		101
Referenced Procedures		101
Component Location Index		103
Component Locator Diagram		104

Subject	Chapter/ Section Subject	Page
AUTOLAND MODE (PRE-TRACK AND TRACK) (CONT)	22-14-33	
Fault Detection Test		105
Fault Isolation		109
AUTOLAND TRACK MODE (ALIGN, FLARE AND ROLLOUT) FAULT ISOLATION	22-14-35	
General		101
Equipment and Materials		101
Referenced Procedures		101
Component Location Index		102
Component Locator Diagram		103
Fault Detection Test		104
Fault Isolation		111
YAW STABILITY AUGMENTATION SYSTEM	22-15-00	
General		101
Fault Isolation Identification		101
Component Location Index		104
Component Locator Diagram		105
Yaw SAS System Fault Matrix		108
Yaw SAS System Faults		110
Yaw SAS Block Diagram		133/134
R Yaw SAS Power Distribution Schematic		135/136
Yaw SAS Basic Mode Signal Flow Schematic		139/140
Yaw SAS Runway Align and Rollout Signal Flow Schematic		143/144
Yaw SAS Engage Logic Schematic		145/146
Yaw SAS Align Arm, Align, and Rollout Logic Schematic		149/150
Yaw SAS FD Valid, No Align, Yaw CAT III Avail, and Yaw No First Fail Logic Schematic		153/154
Yaw SAS Flap Position Logic Schematic		157/158
Yaw SAS FIM Schematic		159/160
FLIGHT CONTROL ELECTRONICS SYSTEM	22-17-00	
General		101
Referenced Procedures		101
Fault Isolation/Identification		101
Component Location Index		104
Component Location Diagram		105
Component Locator Diagram		106
FCES Computer Block Diagram		111/112
FCES Computer Secondary Power Distribution		113/114
Stall Warning		117/118

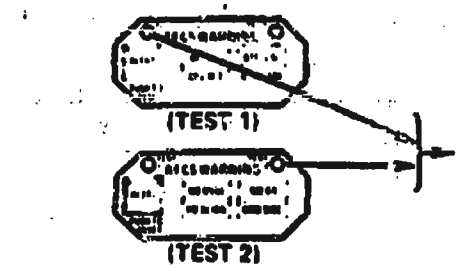
Subject	Chapter/ Section Subject	Page
FLIGHT CONTROL ELECTRONICS SYSTEM (CONT)	22-17-00	
Altitude Alert		121/122
Stabilizer Hydraulics and Pitch Aft Coupler Control		125/126
Stabilizer Annunciator Logic		129/130
Aileron Hydraulics Control		133/134
Spoiler Hydraulics Control		135/136
Aileron and Spoiler Annunciator Logic		137/138
DLC/AGSB Analog Signal Flow Schematic		141/142
DLC/AGSB System No. 1 Logic		143/144
DLC/AGSB System No.1 Logic Schematic		145/146
DLC/AGSB System No. 1 Logic		147/148
DLC/AGSB System No. 2 Logic		149/150
FCES FIM		153/154
STALL WARN SYSTEM	22-17-05	
General		101
Fault Isolation Identification		101
Component Locator Index		103
Component Locator Diagram		104
Stall Warn System Fault Matrix		105
Stall Warn Test Faults		107
Stall Warn Faults		112
Stall Warn Schematic		119/120
ALTITUDE ALERT SYSTEM	22-17-06	
Fault Isolation Identification		101
Component Location Index		104
Component Locator Diagram		105
Altitude Alert Fault Matrix		106
Altitude Alert Approach Faults		108
Altitude Alert Deviation Faults		111
Altitude Alert Test Faults		114
DIRECT LIFT CONTROL/AUTOMATIC GROUND SPOILER	22-17-07	
General		101
Fault Isolation Identification		101
R Component Location Index		103

Subject	Chapter/ Section Subject	Page
DIRECT LIFT CONTROL/AUTOMATIC GROUND SPOILER (CONT)	22-17-07	
Component Locator Diagram		104
R DLC/AGS System Fault Matrix		108
DLC Faults		111
AGS Faults		130
PFCS MONITORING	22-17-09	
General		101
Fault Isolation Identification		101
Component Location Index		103
Component Locator Diagram		104
Loss of FCES Computer 28 VDC Excitation Power Faults		106
TRIM AUGMENTATION SYSTEM	22-18-00	
General		101
Referenced Procedures		101
Equipment and Materials		101
Fault Isolation Identification		102
Component Location Index		104
Component Locator Diagram		105
Pitch Trim Fault Matrix		106
Automatic Pitch Trim Fault Isolation		109
Manual Override of Automatic Pitch Trim Fault Isolation		116
Manual Override of Manual Pitch Trim Fault Isolation		118
Manual Override of Automatic Pitch Trim Fault Isolation		119
Manual Pitch Trim Fault Isolation		120
Trim Augmentation Computer Power Distribution Schematic		143/144
Pitch Trim Signal Flow Schematic		145/146
Pitch Trim Engage/Fail Logic Schematic		149/150
Pitch Trim Switching Logic Schematic		151/152
Trim Augmentation Computer FIM Schematic		153/154

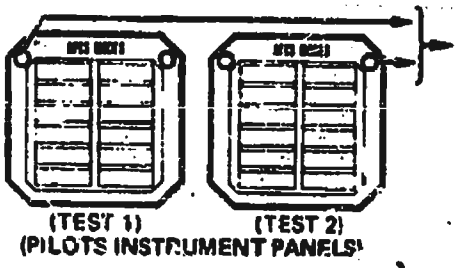
Subject	Chapter/ Section Subject	Page
MACH TRIM AND FEEL SYSTEM	22-21-00	
General		101
Referenced Procedures		101
Equipment and Materials		101
Fault Isolation Identification		102
Component Location Index		104
Component Locator Diagram		105
Mach Trim/Feel Fault Matrix		106
Mach Trim Fault Isolation		107
Mach Feel Fault Isolation		113
Upper Mach Feel Sync Shaft Location		147/148
Trim Augmentation Computer Power Distribution Schematic		149/150
Mach Trim Signal Flow Schematic		151/152
Mach Trim Logic Schematic		153/154
Mach Feel Signal Flow Schematic		155/156
Mach Feel Logic Schematic		157/158
Trim Augmentation Computer FIM Schematic		159/160
SPEED CONTROL SYSTEM	22-31-00	
General		101
Referenced Procedures		101
Equipment and Materials		101
Fault Isolation Identification		101
Component Location Index		103
Component Locator Diagram		104
Autothrottle/Speed System Fault Identification		108
Single ATS FAIL Light Faults		111
ATS DISC/Dual FAIL Lights Faults		115
Other Autothrottle/Speed System Faults		124
Speed Control Computer Power Distribution		161/162
Autothrottle Signal Flow		163/164
R Takeoff/Go-Around Signal Flow		167/168
Autothrottle Switching and Alpha Annunciation		171/172
Takeoff/Go-Around Switching Logic		173/174
R Autothrottle Engage and Disconnect Warning R Logic		175/176
Autothrottle Interlock and Motor Control Enable Logic		177/178
Takeoff/Go-Around Valid and No Go-Around Annunciation Logic		179/180
R Speed Control System Monitor Logic		181/182

Subject	Chapter/ Section Subject	Page
SPEED CONTROL SYSTEM (CONT)	22-31-00	
Speed Computer FIM		103/104

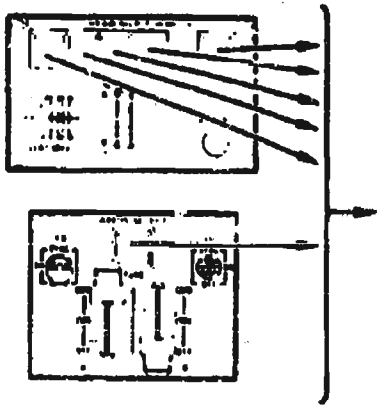
AUTOFLIGHT CONTENTS



AFCS WARNING INDICATOR TEST



AFCS MODES ANNUNCIATOR TEST



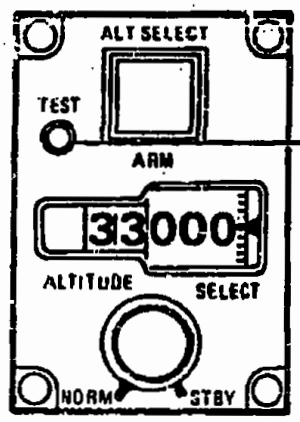
AFCS MODES ANNUNCIATOR TEST

TITLE	CHAP/SEC
AFCS MODES ANNUNCIATOR TEST	2202
AFCS WARNING INDICATOR TEST	2202

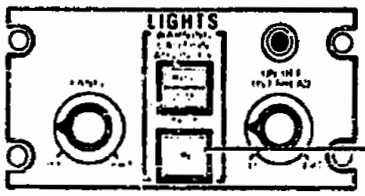
M1-0001-22-6313

PRESS-TO-TEST CONTENTS

R EFFECTIVITY: ALL
R
001B

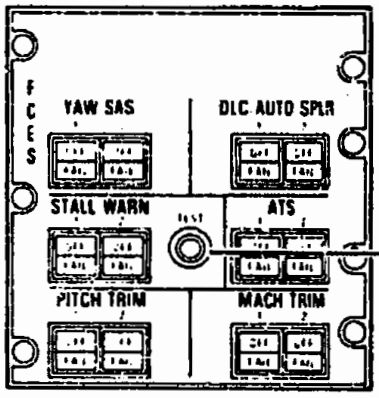


ALTITUDE ALERT TEST



(PILOTS OVERHEAD PANEL)

AFCS MODES
ANNUNCIATOR TEST
AFCS LIGHTS TEST
AIRCRAFT GENERAL



(PILOTS OVERHEAD PANEL)

STALL WARNING TEST

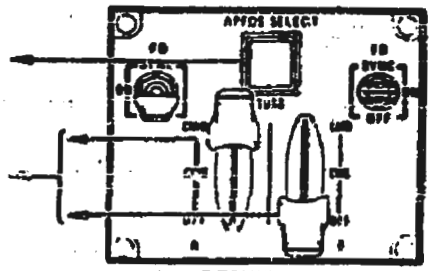
TITLE	CHAP/SEC
AFCS LIGHTS TEST	3317
AFCS MODES ANNUNCIATOR TEST	2202
ALTITUDE ALERT TEST	2217
STALL WARN TEST	2217

M1-0000-22-9404

PRESS-TO-TEST CONTENTS

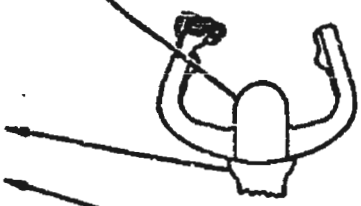
R EFFECTIVITY: ALL
R
0018

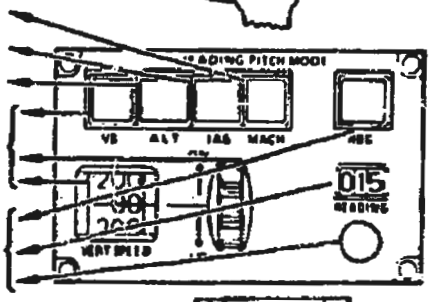
AUTOFLIGHT CONTENTS

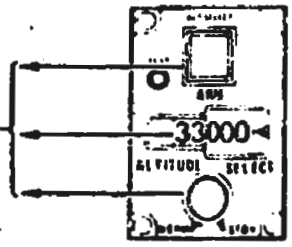


(GLARESHIELD PANEL)

(TEST 1)
(PILOTS INSTRUMENT PANELS)







(GLARESHIELD PANEL)

TITLE	CHAP/SEC
AP ALT SEL/HOLD MODE	2211
AP CWS CRUISE MODE	2210
AP HEADING SELECT MODE	2213
AP IAS MODE	2211
AP LOCKED-OFF	2210
AP MACH MODE	2211
AP VS MODE	2211
AP WILL NOT REMAIN ENGAGED	2210
CONTROL COLUMN BUZZ	2211

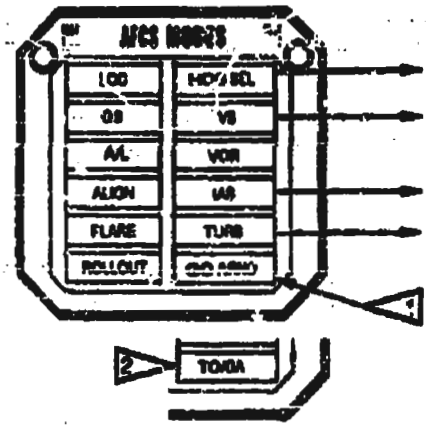
M1-0000-22-9340

AUTOPILOT CONTENTS

R
R
001B

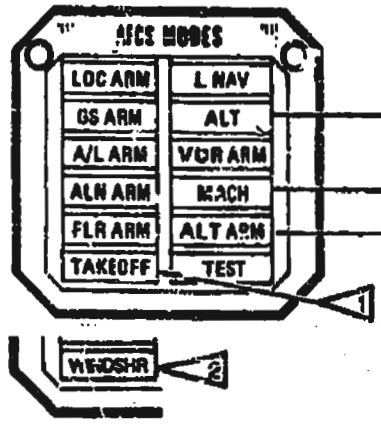
EFFECTIVITY: ALL

AUTOFLIGHT CONTENTS



AP HEADING SELECT MODE
AP VS MODE
AP IAS MODE
AP CWS CRUISE MODE

(TEST 1)



AP ALT SEL/HOLD MODE
AP MACH MODE
AP ALT SEL/HOLD MODE

(TEST 2)

(PILOTS INSTRUMENT PANELS)

AIRCRAFT PORPOISING → AIRCRAFT PORPOISING WITH AP TURNED-ON

NOTE

1 AIRCRAFT WITHOUT SB34-178

2 AIRCRAFT WITH SB34-178

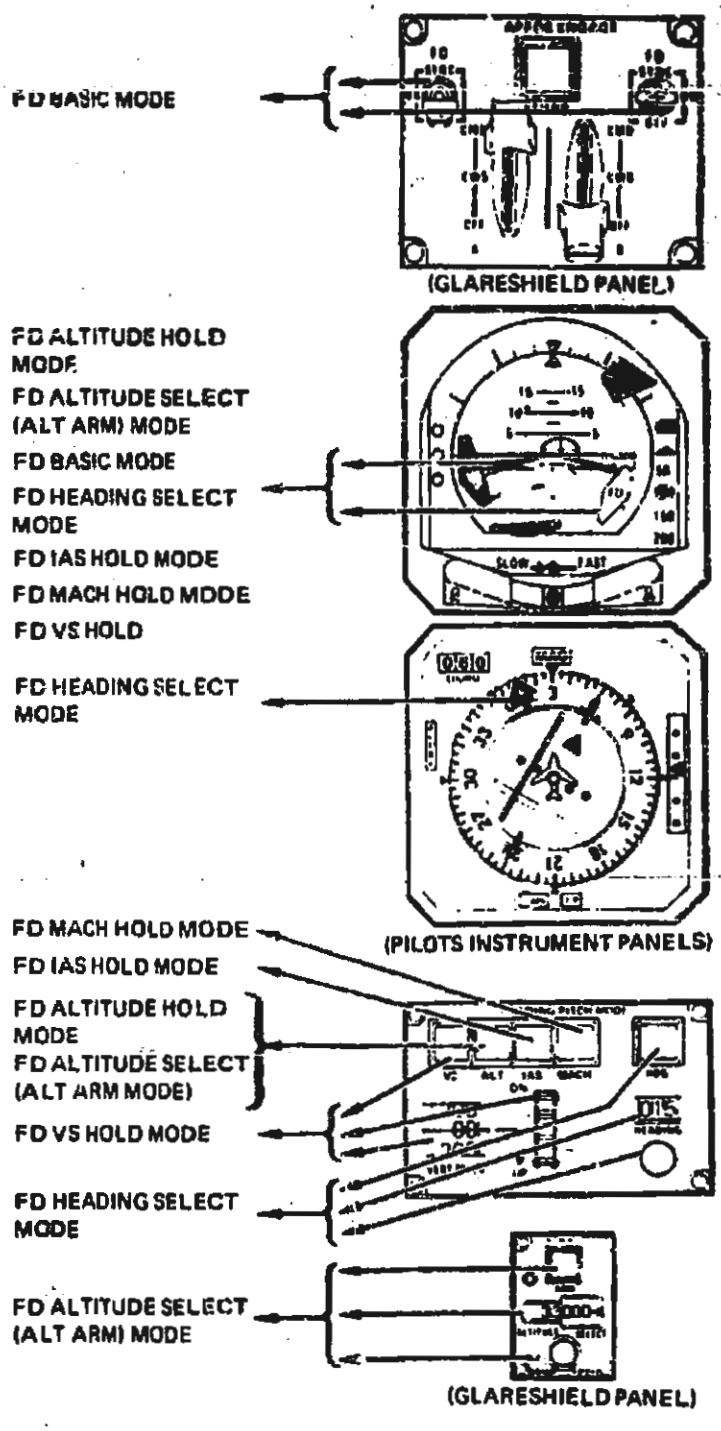
TITLE	CHAP/SEC
AIRCRAFT PORPOISING WITH AP TURNED-ON	2210
AP ALT SEL/HOLD MODE	2211
AP CWS CRUISE MODE	2210
AP HEADING SELECT MODE	2213
AP IAS MODE	2211
AP MACH MODE	2211
AP VS MODE	2211

M1-1000-22-4*33

AUTOPILOT CONTENTS

R EFFECTIVITY: ALL
R
001B

AUTOFLIGHT CONTENTS

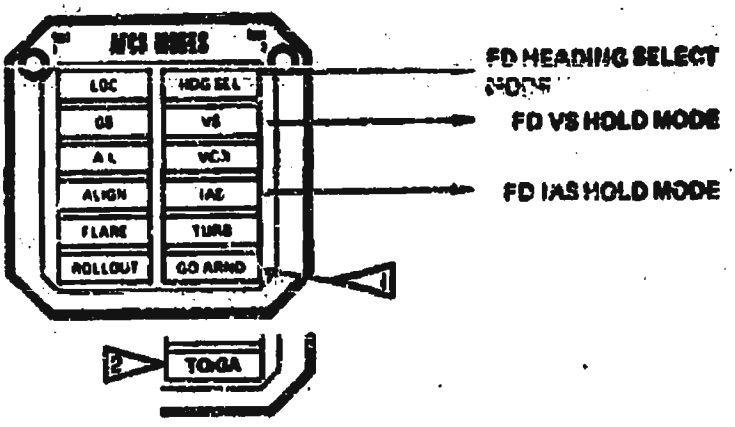


TITLE	CHAP/SEC
FD ALTITUDE HOLD MODE	2211
FD ALTITUDE SELECT (ALT ARM) MODE	2211
FD BASIC MODE	2210
FC HEADING SELECT MODE	2213
FD IAS HOLD MODE	2211
FD MACH HOLD MODE	2211
FD VS HOLD MODE	2211

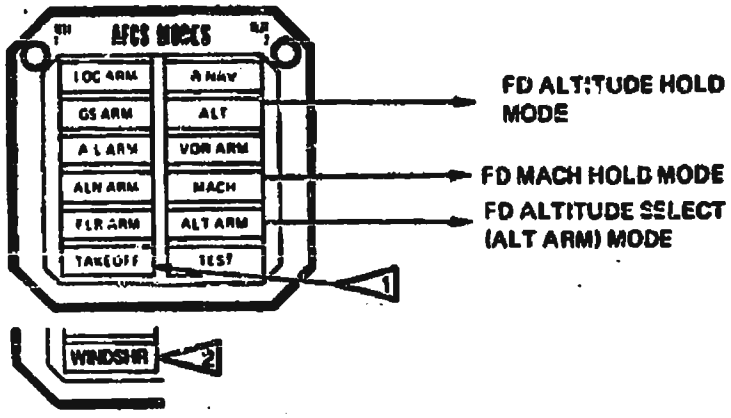
M1-0000-22-9327

FLIGHT DIRECTOR CONTENTS

AUTOFLIGHT CONTENTS



(TEST 1)



(TEST 2)

(PILOTS INSTRUMENT PANELS)

NOTE

1 AIRCRAFT WITHOUT SB34-178

2 AIRCRAFT WITH SB34-178

TITLE	CHAP/SEC
FD ALTITUDE HOLD MODE	2211
FD ALTITUDE SELECT (ALT ARM) MODE	2211
FD HEADING SELECT MODE	2213
FD IAS HOLD MODE	2211
FD MACH HOLD MODE	2211
FD VS HOLD MODE	2211

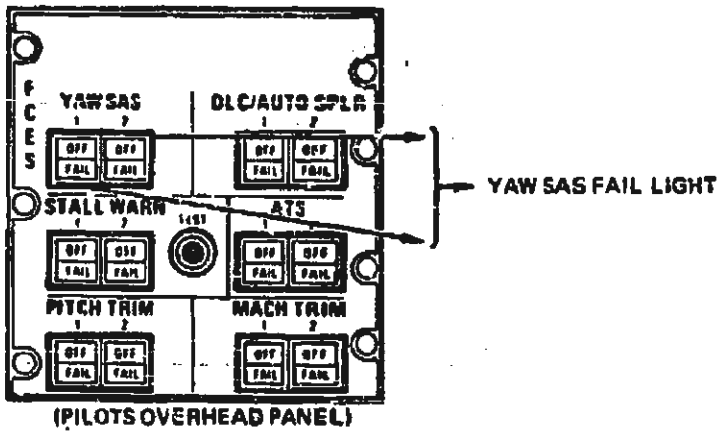
M1-0000-22-4494

R FLIGHT DIRECTOR CONTENTS

EFFECTIVITY: ALL

001B

AUTOFLIGHT CONTENTS

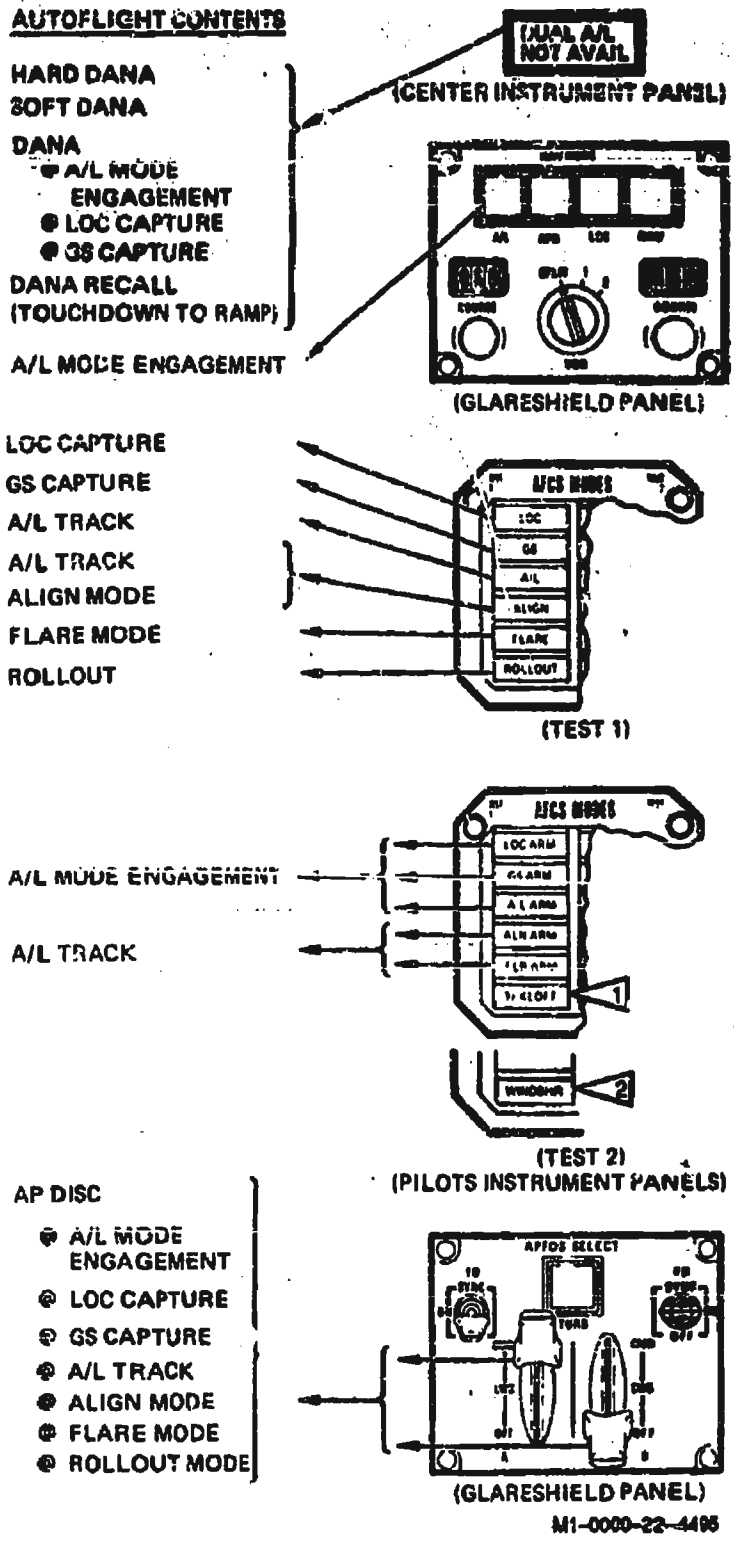


(PILOTS OVERHEAD PANEL)

TITLE	CHAP/SEC
YAW SAS FAIL LIGHT	2215

M1-0300-22-0323

YAW SAS CONTENTS



NOTE

1 AIRCRAFT WITHOUT SB34-178

2 AIRCRAFT WITH SB34-178

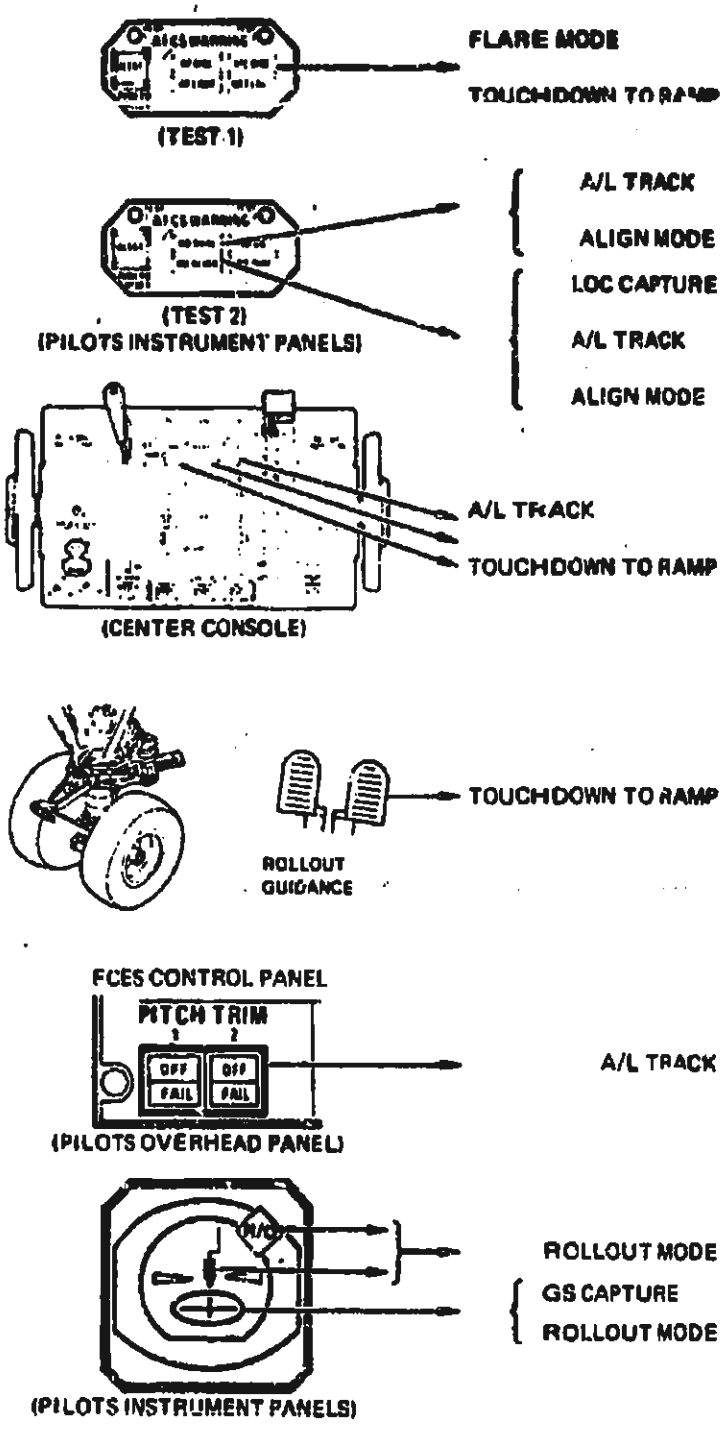
TITLE	CHAP/SEC
A/L MODE ENGAGEMENT	2214
A/L TRACK	2214
ALIGN MODE	2214
AP DISC	
@ A/L MODE ENGAGEMENT	2214
@ LOC CAPTURE	2214
@ GS CAPTURE	2214
@ A/L TRACK	2214
@ ALIGN MODE	2214
@ FLARE MODE	2214
@ ROLLOUT MODE	2214
DANA	
@ A/L MODE ENGAGEMENT	2214
@ LOC CAPTURE	2214
@ GS CAPTURE	2214
DANA RECALL (TOUCHDOWN TO RAMP)	2214
FLARE MODE	2214
GS CAPTURE	2214
HARD DANA	2212
LOC CAPTURE	2214
ROLLOUT	2214
SOFT DANA	2212

R DANA AND AUTOLAND CONTENTS

EFFECTIVITY: ALL

001B

AUTOFLIGHT CONTENTS



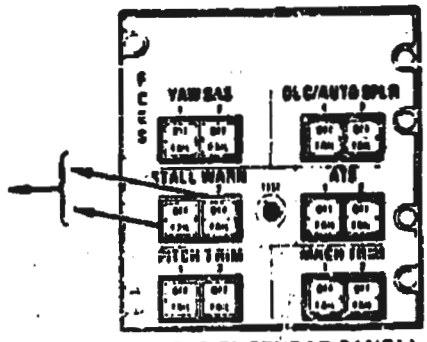
TITLE	CHAP/SEC
ALIGN MODE	2214
A/L TRACK	2214
FLARE MODE	2214
GS CAPTURE	2214
LOC CAPTURE	2214
ROLLOUT MODE	2214
TOUCHDOWN TO RAMP	2214

M1-0000-22-0303

DANA AND AUTOLAND CONTENTS

AUTOFLIGHT CONTENTS

STALL WARNING



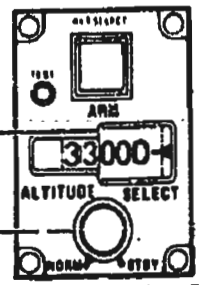
(PILOTS OVERHEAD PANEL)

STALL WARNING

(STICK SHAKER)

ALTITUDE ALERT APPROACH

ALTITUDE ALERT DEVIATION



(GLARESHIELD PANEL)

ALTITUDE ALERT APPROACH

ALTITUDE ALERT DEVIATION

(PILOTS INSTRUMENT PANELS)

ALTITUDE ALERT APPROACH

ALTITUDE ALERT DEVIATION

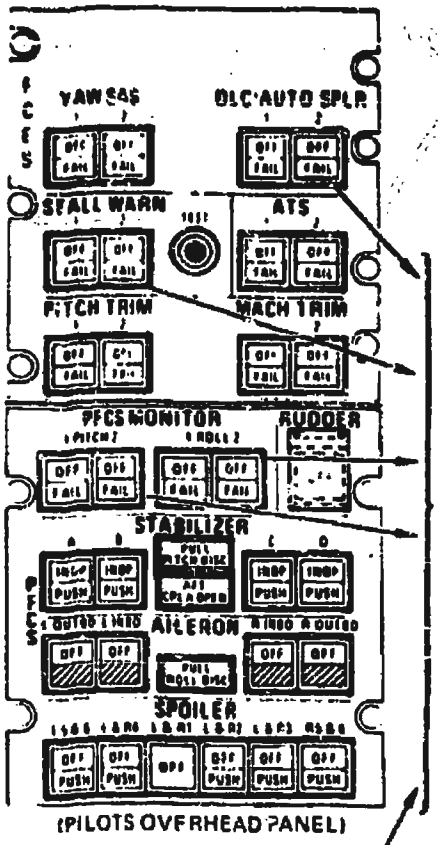
(ALT ALERT)

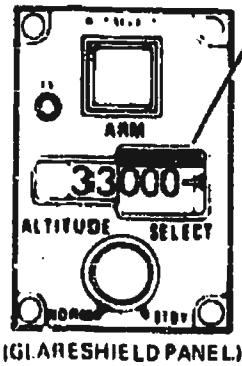
TITLE	CHAP/SEC
ALTITUDE ALERT APPROACH	2217
ALTITUDE ALERT DEVIATION	2217
STALL WARNING	2217

M1-0001-22-9324

STALL AND ALT AND PFCS CONTENTS

AUTOFLIGHT CONTENTS



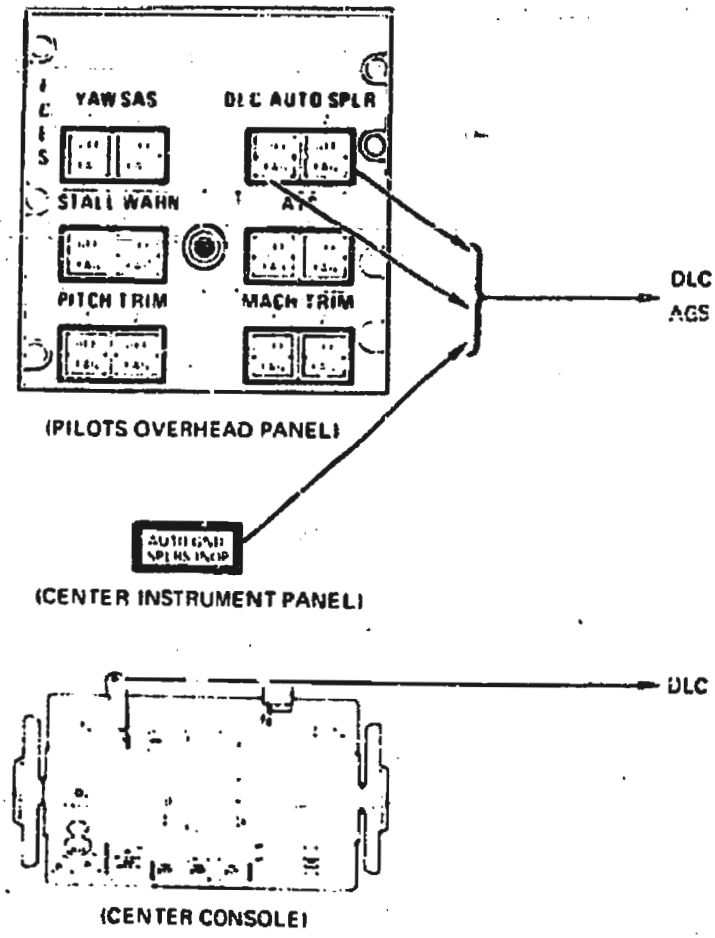


TITLE CHAP/SEC
SIMULTANEOUS FAILURE OF PFCS MONITOR, DLC/AUTO SPLR, STALL WARN, AND ALT SELECT 2217

M1-0000-22-9300

STALL ALT ANN PFCS CONTENTS

AUTOFLIGHT CONTENTS



TITLE	CHAP/SEC
AGS	2217
DLC	2217

M1 3000 22 0350

DLC AND AGSB CONTENTS

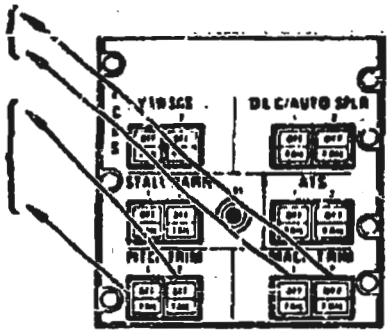
EFFECTIVITY: ALL

R
R
001B

AUTOFLIGHT CONTENTS

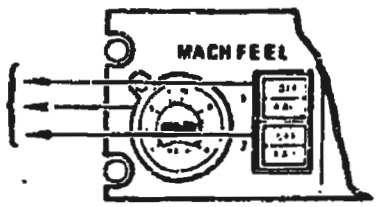
MACH TRIM AND FEEL

AUTOMATIC PITCH TRIM
MANUAL OVRD OF AUTO PITCH TRIM
MANUAL PITCH TRIM (THUMBWHEEL)

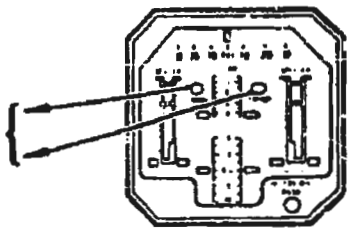


(PILOTS OVERHEAD PANEL)

MACH TRIM AND FEEL

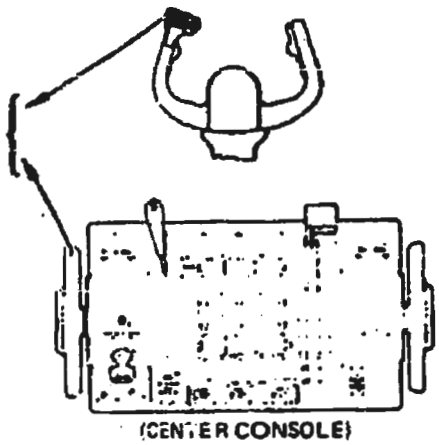


AUTOMATIC PITCH TRIM



(MAIN INSTRUMENT PANEL)

MANUAL OVRD OF AUTO PITCH TRIM
MANUAL PITCH TRIM



(CENTER CONSOLE)

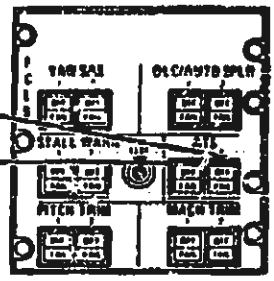
M1 0000-22-9305

TITLE	CHAP/SEC
AUTOMATIC PITCH TRIM	2218
MACH TRIM AND FEEL	2221
MANUAL OVRD OF AUTO PITCH TRIM	2218
MANUAL PITCH TRIM	2218

PITCH TRIM AND FEEL CONTENTS

AUTOFLIGHT CONTENTS

AUTOTHROTTLE/SPEED SYSTEM
DUAL ATS FAIL LIGHTS/ATS DISC
SINGLE ATS FAIL LIGHT

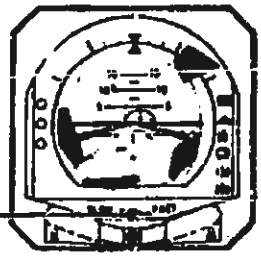


(PILOTS OVERHEAD PANEL)

AUTOTHROTTLE/SPEED SYSTEM
DUAL ATS FAIL LIGHTS/ATS DISC

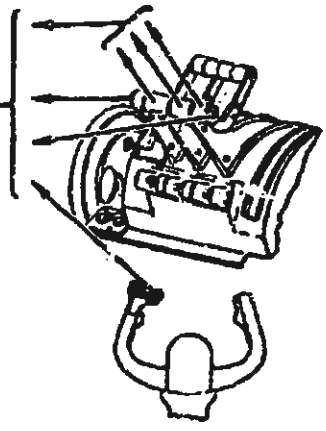
(GLARESHIELD PANEL)

AUTOTHROTTLE/SPEED SYSTEM



(PILOTS INSTRUMENT PANELS)

AUTOTHROTTLE/SPEED SYSTEM

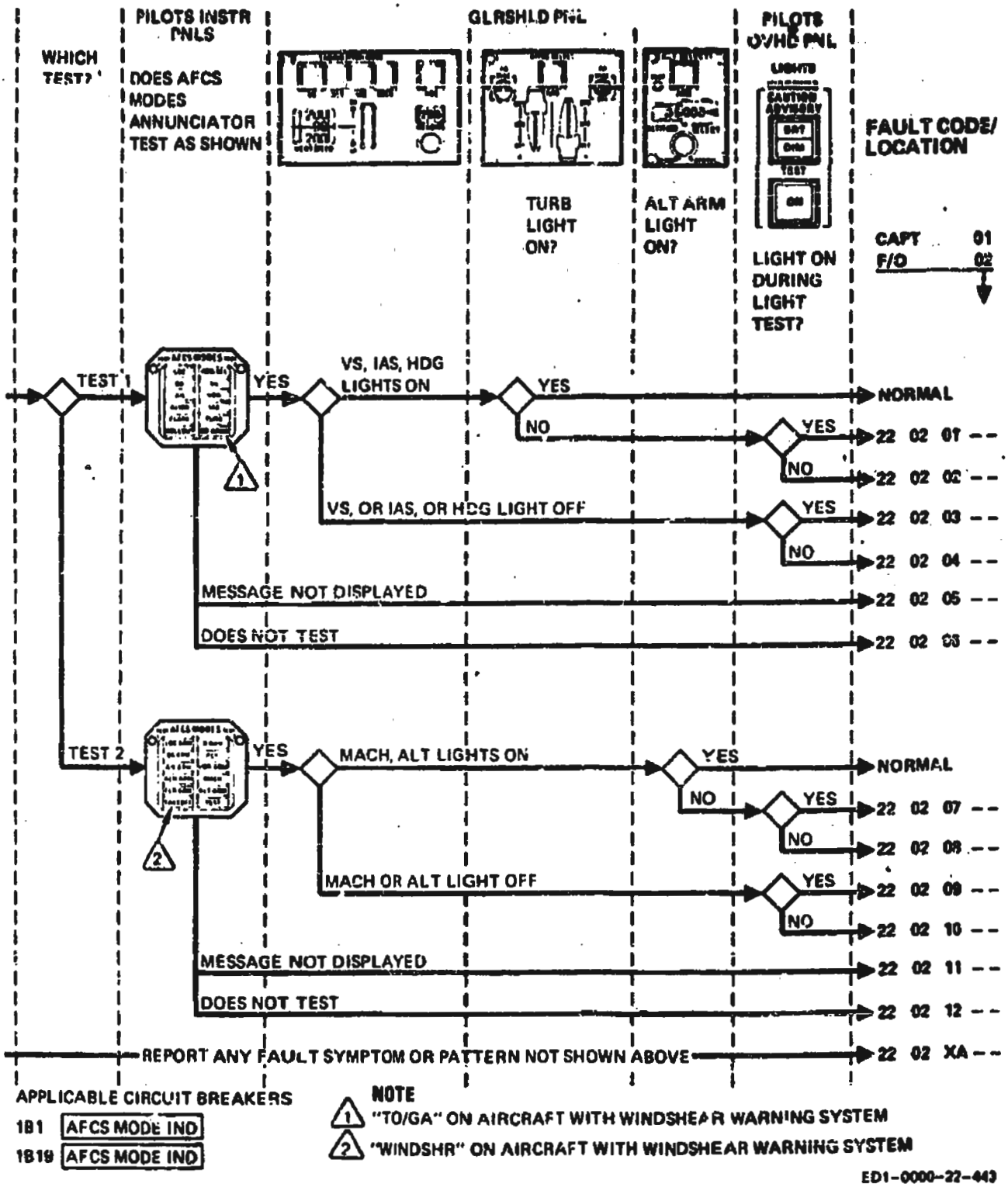


(CENTER CONSOLE)

M1-0J01-22-9306

TITLE	CHAP/SEC
AUTOTHROTTLE/SPEED SYSTEM	2231
DUAL ATS FAIL LIGHTS/ATS DISC	2231
SINGLE ATS FAIL LIGHT	2231

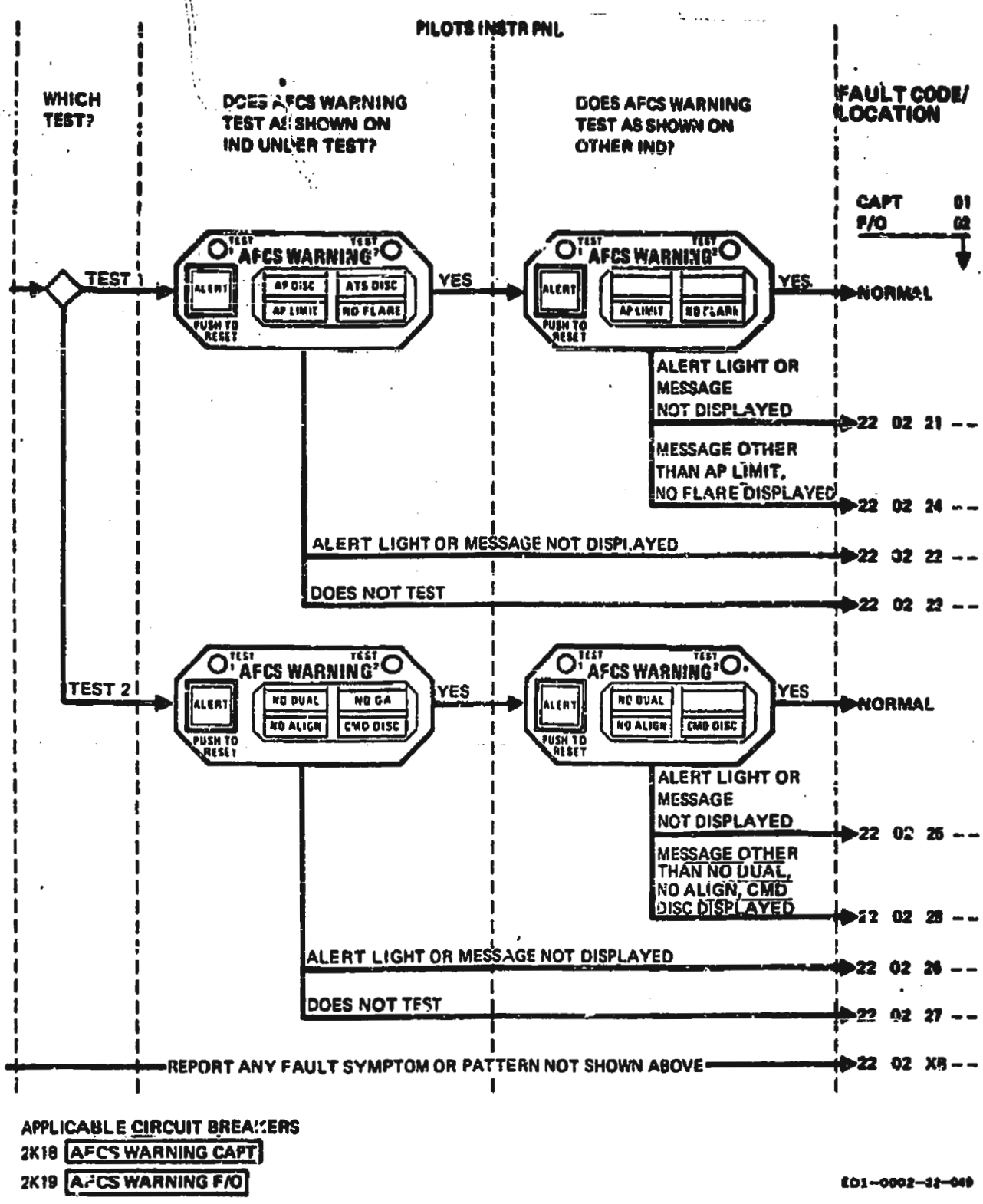
AUTOTHROTTLE AND SPEED CONTENTS



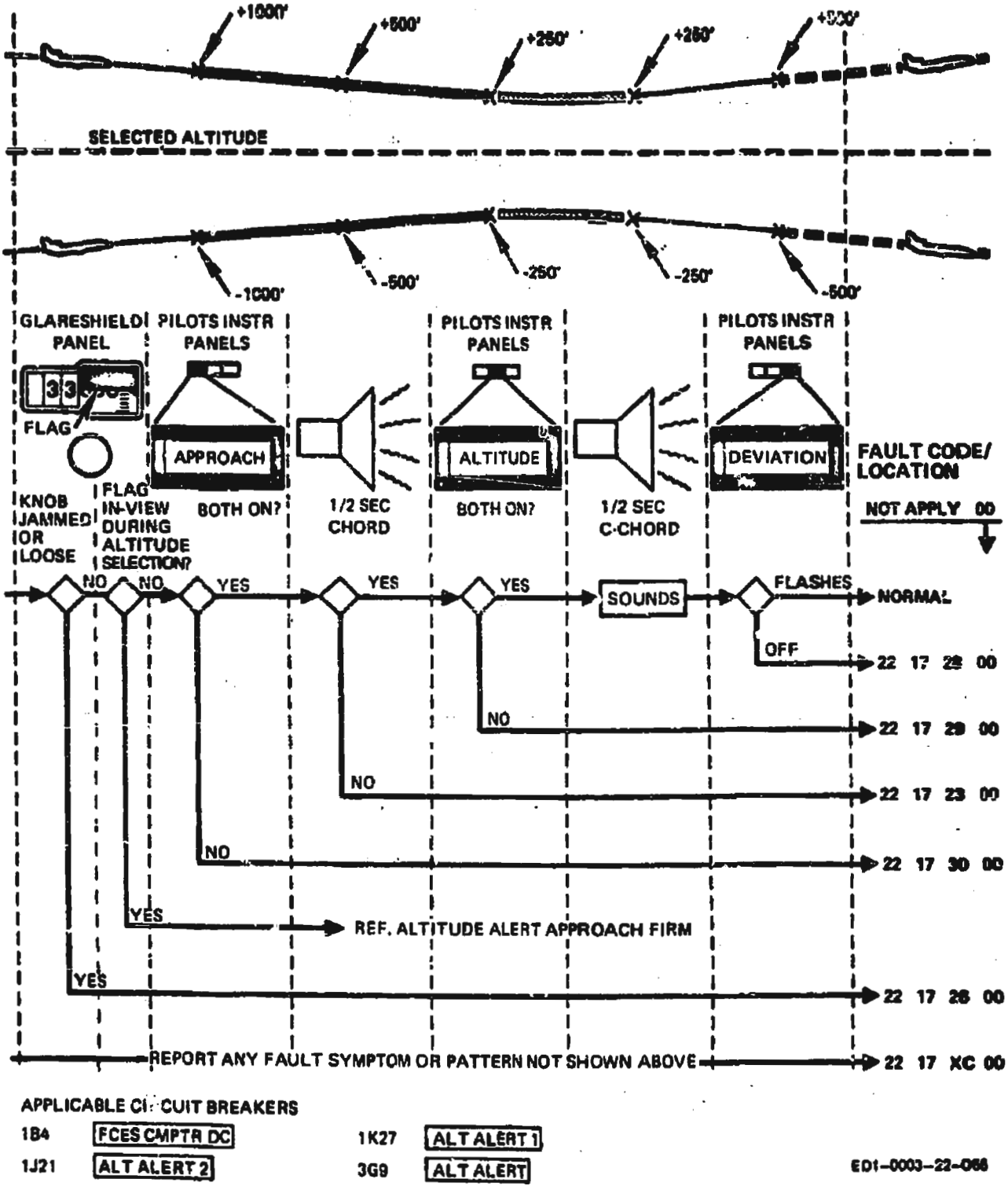
R AFCS MODES Annunciator Test - Fault Codes
Figure 1

R EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM



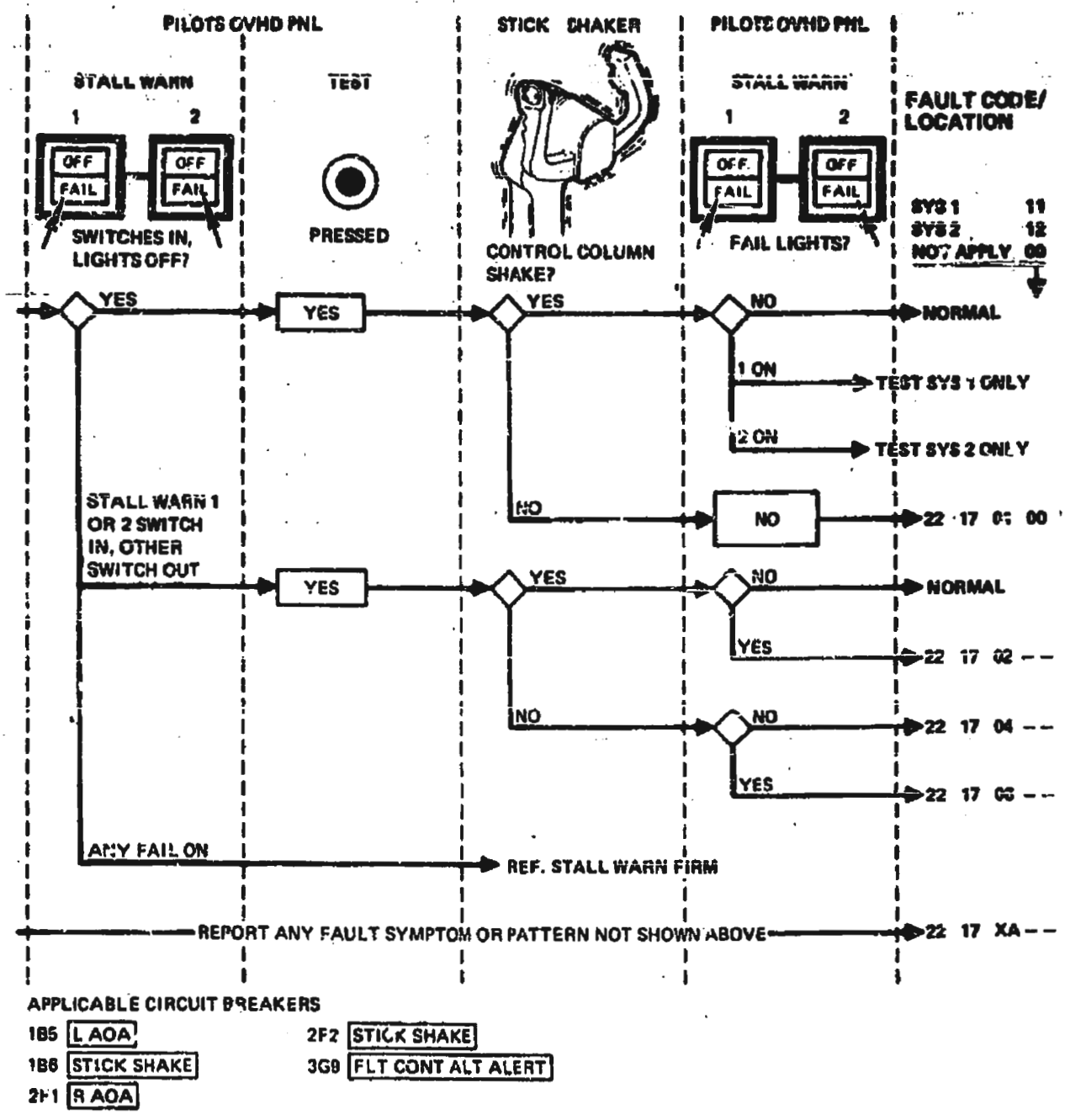
R AFCS WARNING Indicator Test - Fault Codes
Figure 2



R Altitude Alert Test - Fault Codes
Figure 3

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM

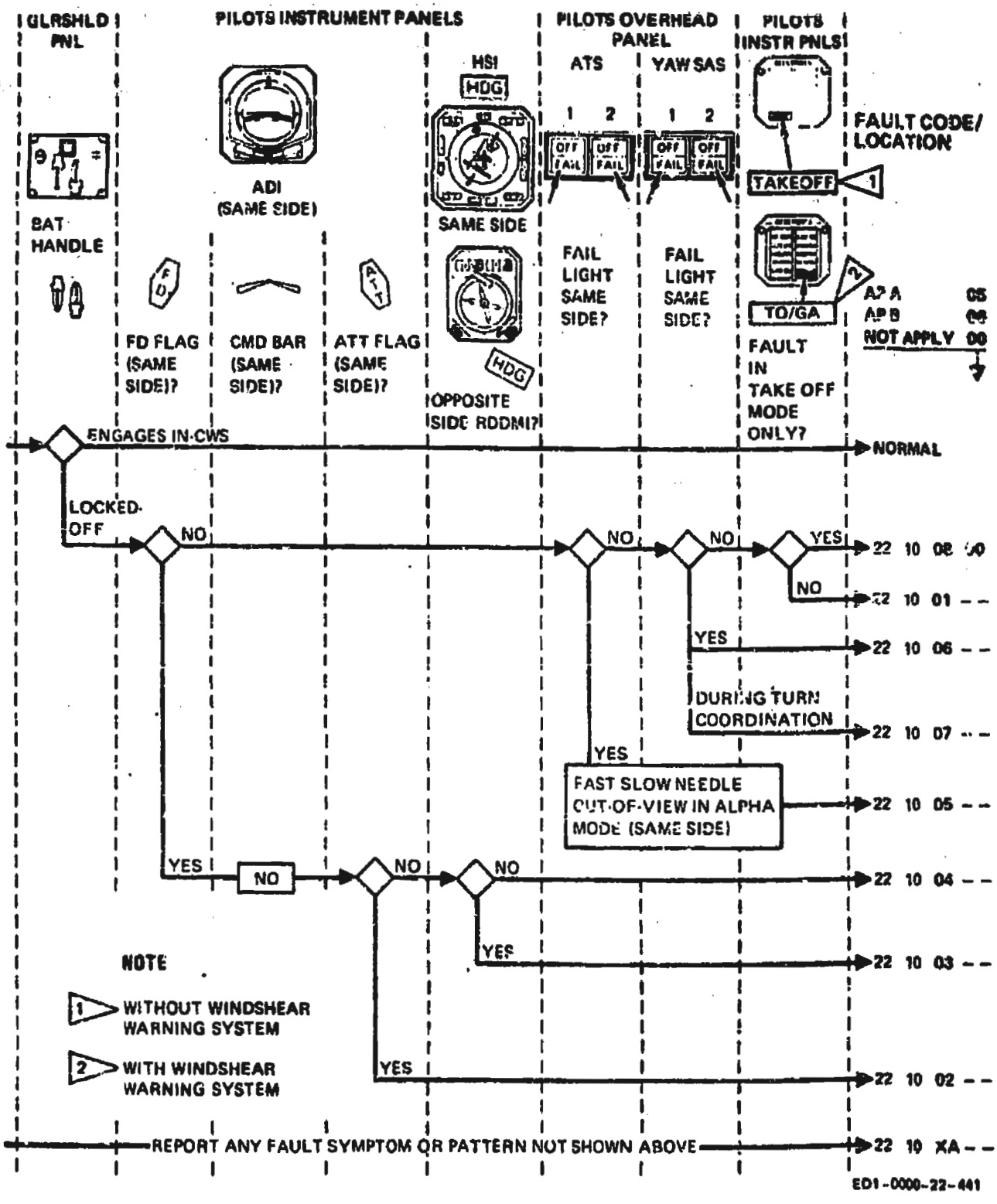


EC1-0004-22-034

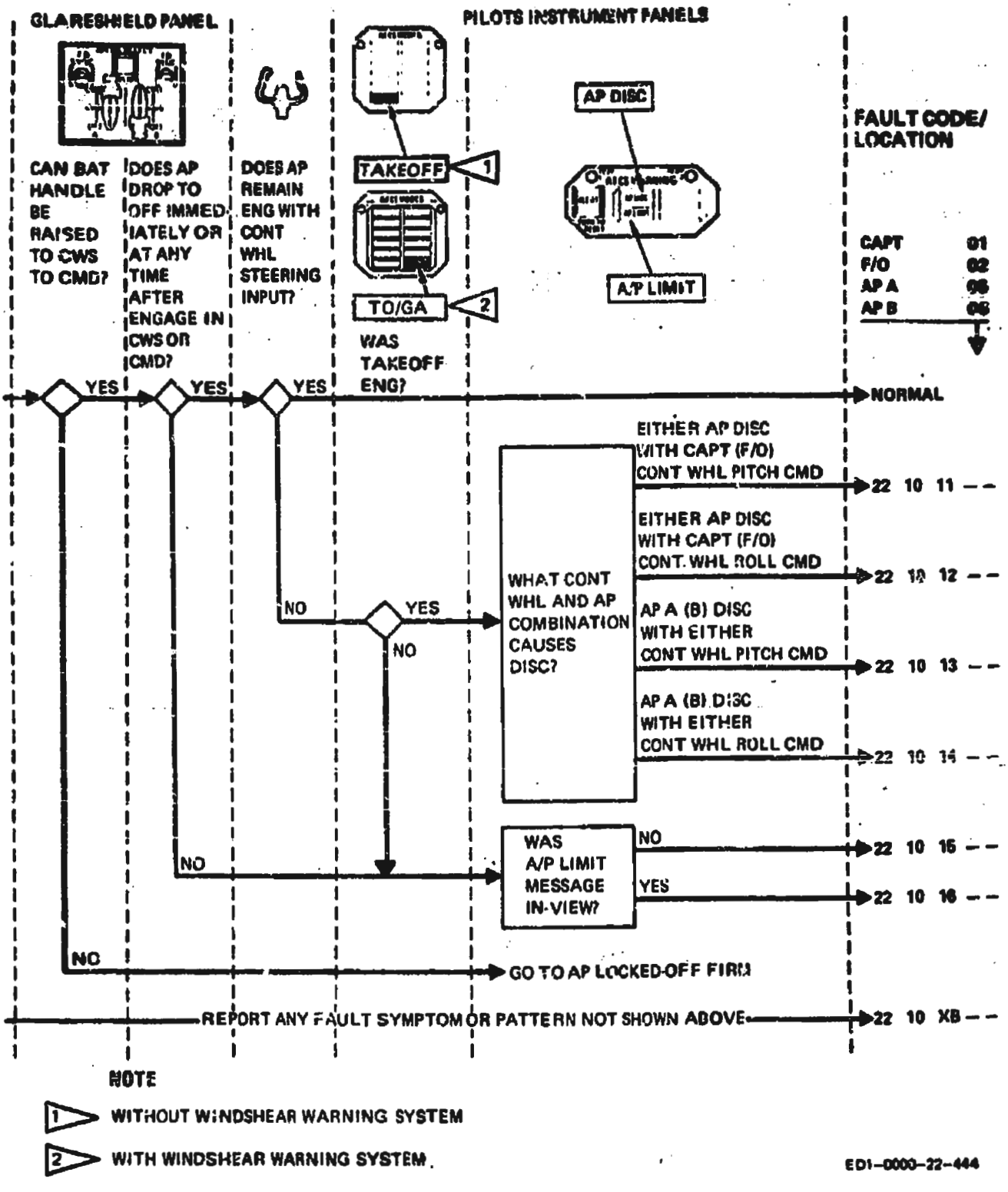
R Stall Warn Test - Fault Codes
Figure 4

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM



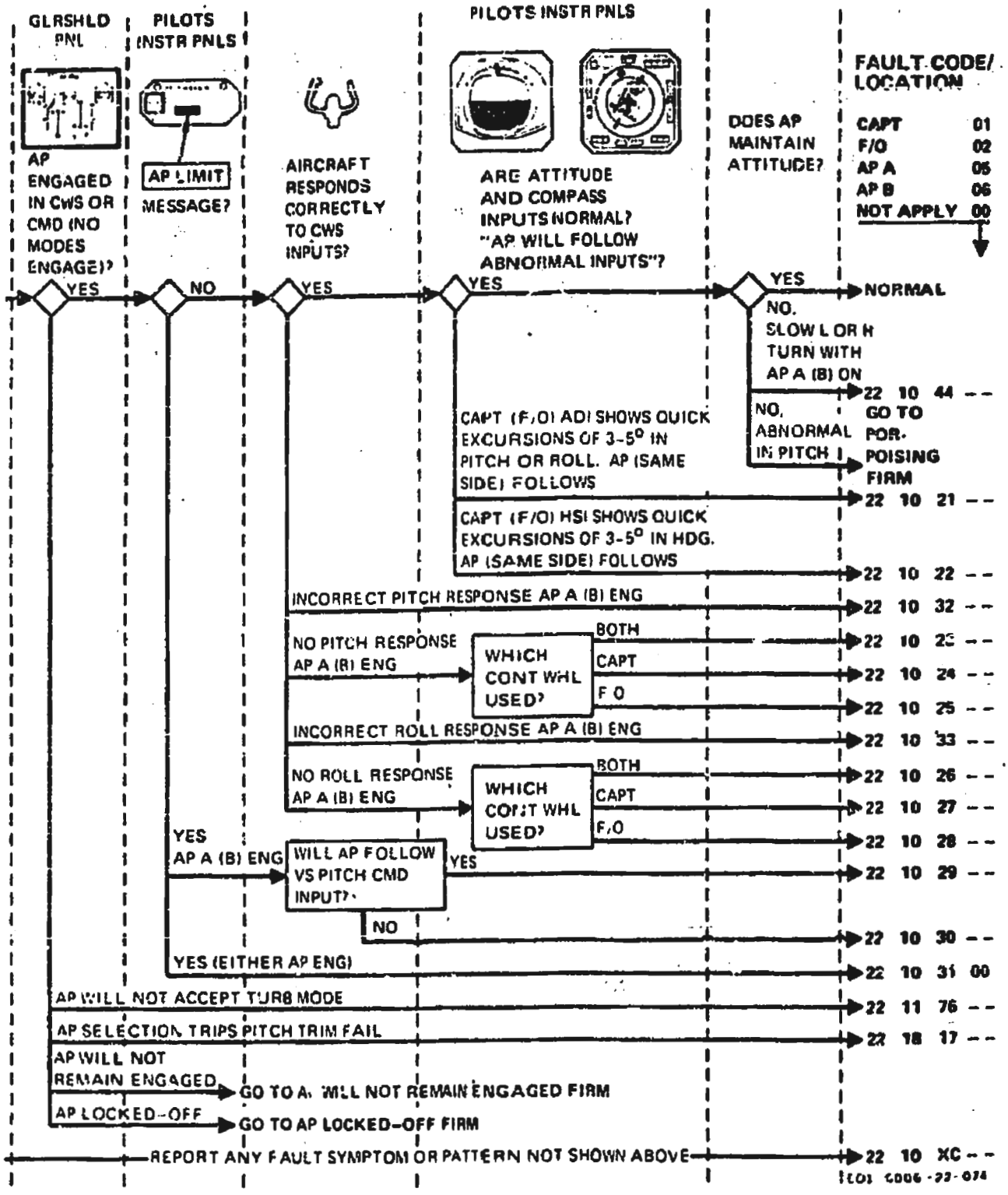
R Autopilot Locked-off - Fault Codes
Figure 5


GLARESHIELD PANEL
PILOTS INSTRUMENT PANELS
AP DISC
A/P LIMIT
TAKEOFF
1
TO/GA
2
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
CAN BAT HANDLE BE RAISED TO CWS TO CMD?
DOES AP DROP TO OFF IMMEDIATELY OR AT ANY TIME AFTER ENGAGE IN CWS OR CMD?
DOES AP REMAIN ENG WITH CONT WHL STEERING INPUT?
WAS TAKEOFF ENG?
YES
YES
YES
NORMAL
NO
YES
NO
WHAT CONT WHL AND AP COMBINATION CAUSES DISC?
EITHER AP DISC WITH CAPT (F/O) CONT WHL PITCH CMD
22 10 11 - -
EITHER AP DISC WITH CAPT (F/O) CONT WHL ROLL CMD
22 10 12 - -
AP A (B) DISC WITH EITHER CONT WHL PITCH CMD
22 10 13 - -
AP A (B) DISC WITH EITHER CONT WHL ROLL CMD
22 10 14 - -
NO
WAS A/P LIMIT MESSAGE IN-VIEW?
NO
22 10 15 - -
YES
22 10 16 - -
NO
GO TO AP LOCKED-OFF FIRST
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 10 XB - -
NOTE
1 WITHOUT WINDSHEAR WARNING SYSTEM
2 WITH WINDSHEAR WARNING SYSTEM.
ED1-0000-22-444

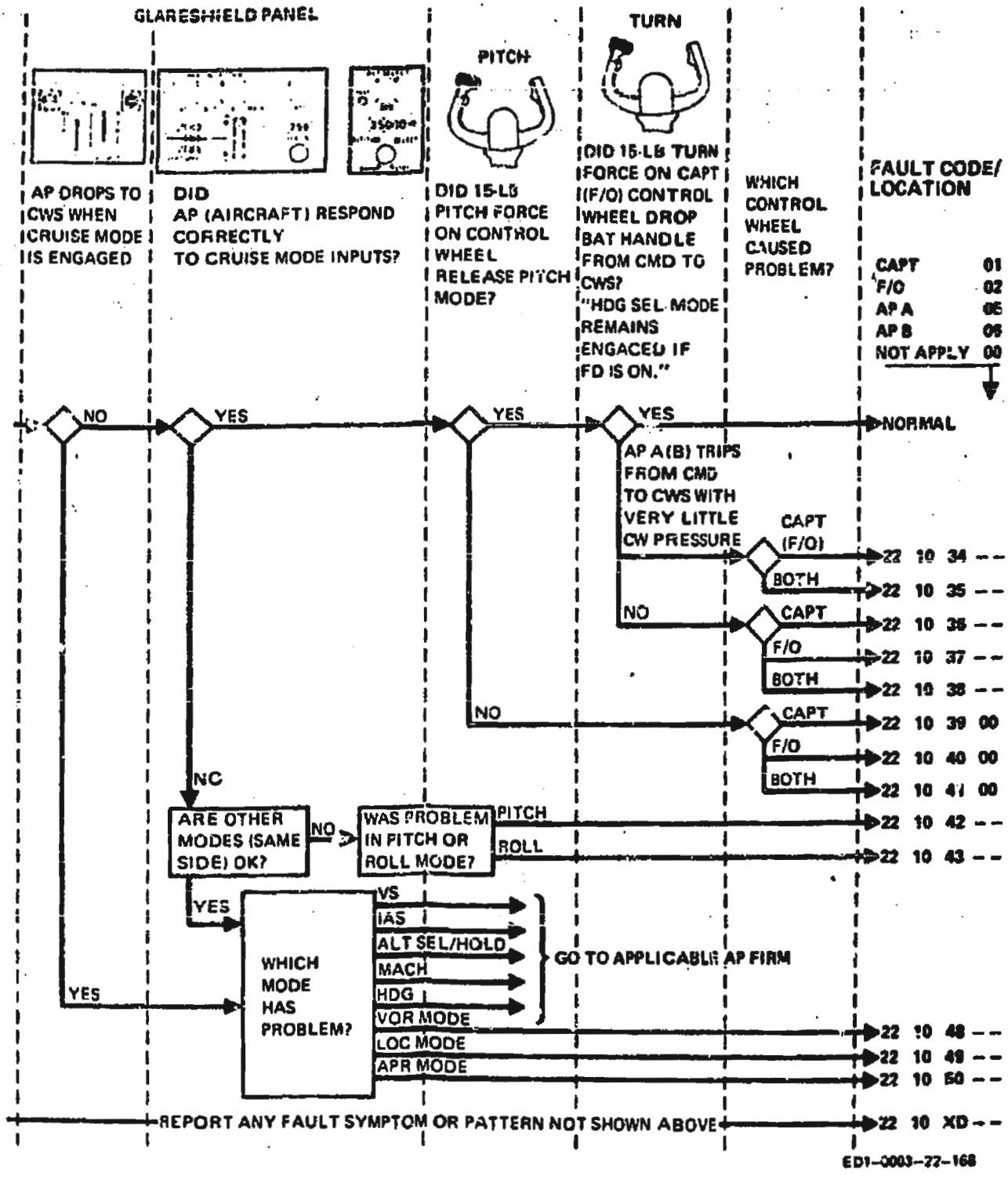
R Autopilot Wll Not Remain Engaged - Fault Codes
Figure 6

R EFFECTIVITY: ALL

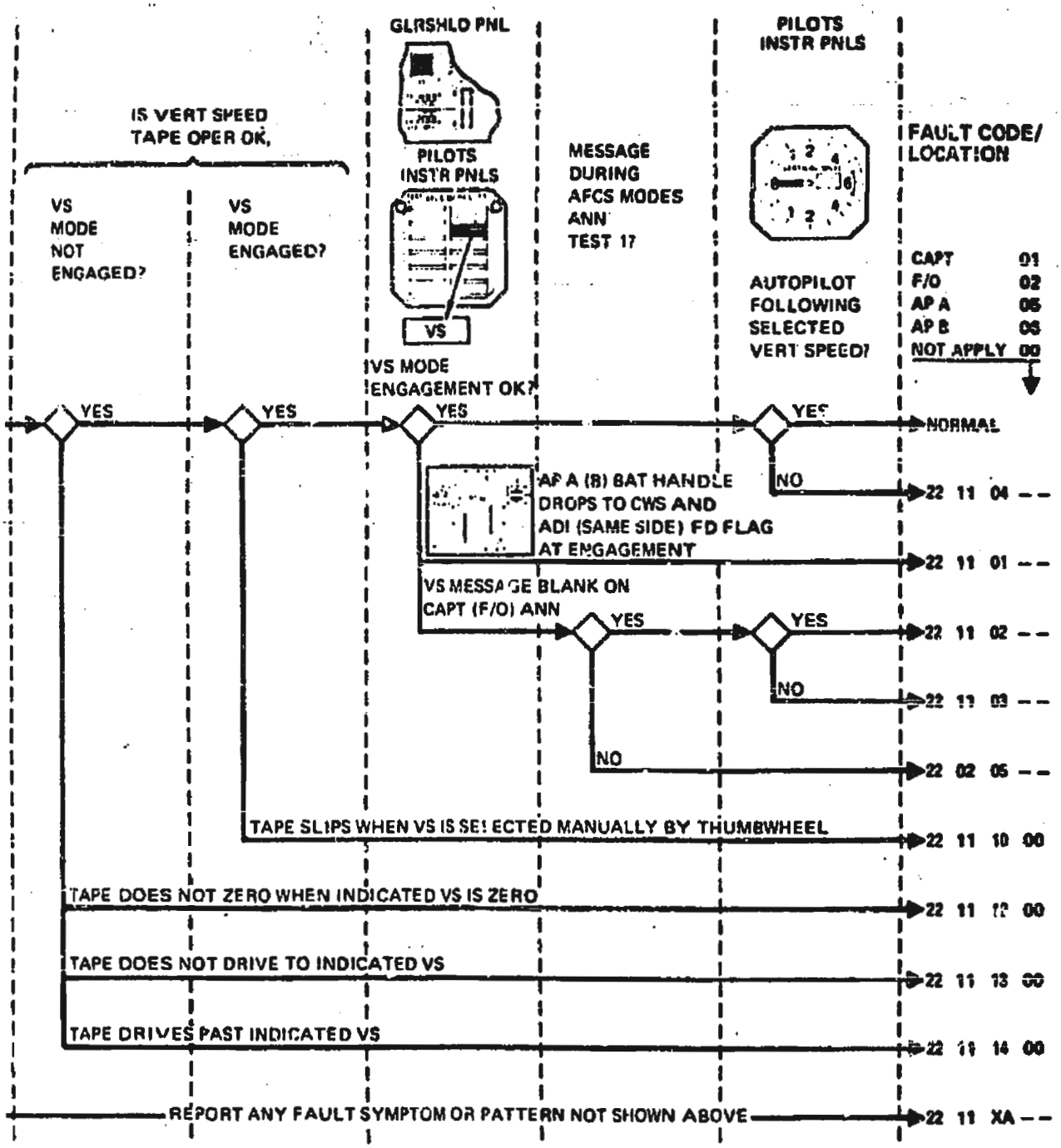
22-FAULT CODE DIAGRAM


GLRSHLD PNL
PILOTS INSTR PNLS
PILOTS INSTR PNLS
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
NOT APPLY 00
AP ENGAGED IN CWS OR CMD (NO MODES ENGAGE)?
AP LIMIT MESSAGE?
AIRCRAFT RESPONDS CORRECTLY TO CWS INPUTS?
ARE ATTITUDE AND COMPASS INPUTS NORMAL? "AP WILL FOLLOW ABNORMAL INPUTS"?
DOES AP MAINTAIN ATTITUDE?
YES
NO
YES
YES
YES
NORMAL
NO. SLOW L OR R TURN WITH AP A (B) ON
22 10 44 -- GO TO POR. POISING FIRM
NO, ABNORMAL IN PITCH
CAPT (F/O) ADI SHOWS QUICK EXCURSIONS OF 3-5° IN PITCH OR ROLL. AP (SAME SIDE) FOLLOWS
22 10 21 --
CAPT (F/O) HSI SHOWS QUICK EXCURSIONS OF 3-5° IN HDG. AP (SAME SIDE) FOLLOWS
22 10 22 --
INCORRECT PITCH RESPONSE AP A (B) ENG
22 10 32 --
NO PITCH RESPONSE AP A (B) ENG
WHICH CONT WHL USED?
BOTH
CAPT
F O
22 10 23 --
22 10 24 --
22 10 25 --
INCORRECT ROLL RESPONSE AP A (B) ENG
22 10 33 --
NO ROLL RESPONSE AP A (B) ENG
WHICH CONT WHL USED?
BOTH
CAPT
F/O
22 10 26 --
22 10 27 --
22 10 28 --
YES AP A (B) ENG
WILL AP FOLLOW VS PITCH CMD INPUT?
YES
22 10 29 --
NO
22 10 30 --
YES (EITHER AP ENG)
22 10 31 00
AP WILL NOT ACCEPT TURB MODE
22 11 76 --
AP SELECTION TRIPS PITCH TRIM FAIL
22 18 17 --
AP WILL NOT REMAIN ENGAGED
GO TO A. WILL NOT REMAIN ENGAGED FIRM
AP LOCKED-OFF
GO TO AP LOCKED-OFF FIRM
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 10 XC --
EO1 0006-22-074

R Autopilot CWS Cruise Mode - Fault Codes
Figure 7



R Autopilot CRUISE Mode - Fault Codes
Figure 8

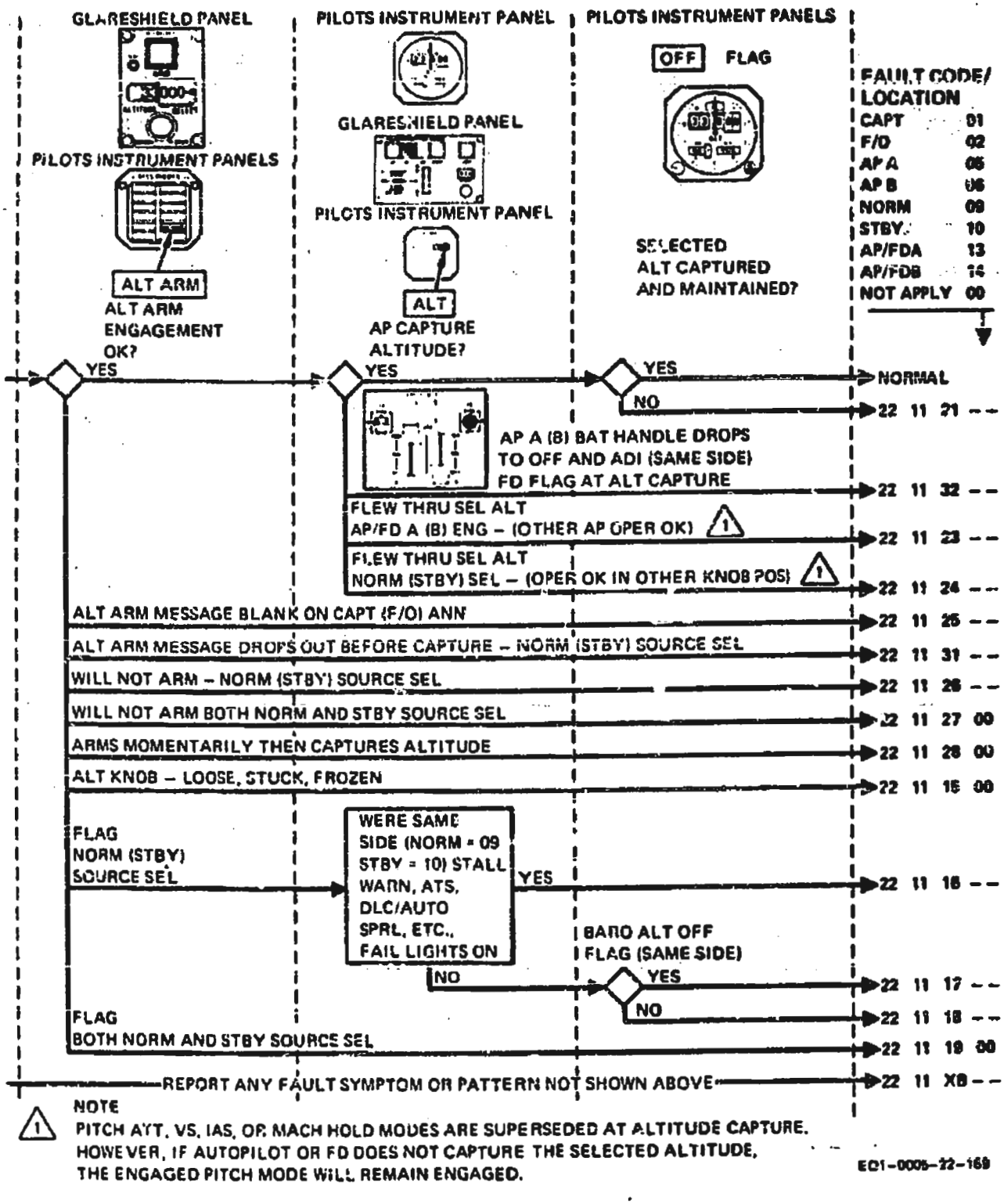

GLRSHLD PNL
PILOTS INSTR PNLS
VS
PILOTS INSTR PNLS
IS VERT SPEED TAPE OPER OK,
VS MODE NOT ENGAGED?
VS MODE ENGAGED?
MESSAGE DURING AFCS MODES ANN TEST 17
VS MODE ENGAGEMENT OK?
AUTOPILOT FOLLOWING SELECTED VERT SPEED?
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
NOT APPLY 00
YES
YES
YES
YES
NORMAL
NO
22 11 04 - -
AP A (B) BAT HANDLE DROPS TO CWS AND ADI (SAME SIDE) FD FLAG AT ENGAGEMENT
22 11 01 - -
VS MESSAGE BLANK ON CAPT (F/O) ANN
YES
YES
22 11 02 - -
NO
22 11 03 - -
NO
22 02 05 - -
TAPE SLIPS WHEN VS IS SELECTED MANUALLY BY THUMBWHEEL
22 11 10 00
TAPE DOES NOT ZERO WHEN INDICATED VS IS ZERO
22 11 12 00
TAPE DOES NOT DRIVE TO INDICATED VS
22 11 13 00
TAPE DRIVES PAST INDICATED VS
22 11 14 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 11 XA - -

ED1-0005-22-151

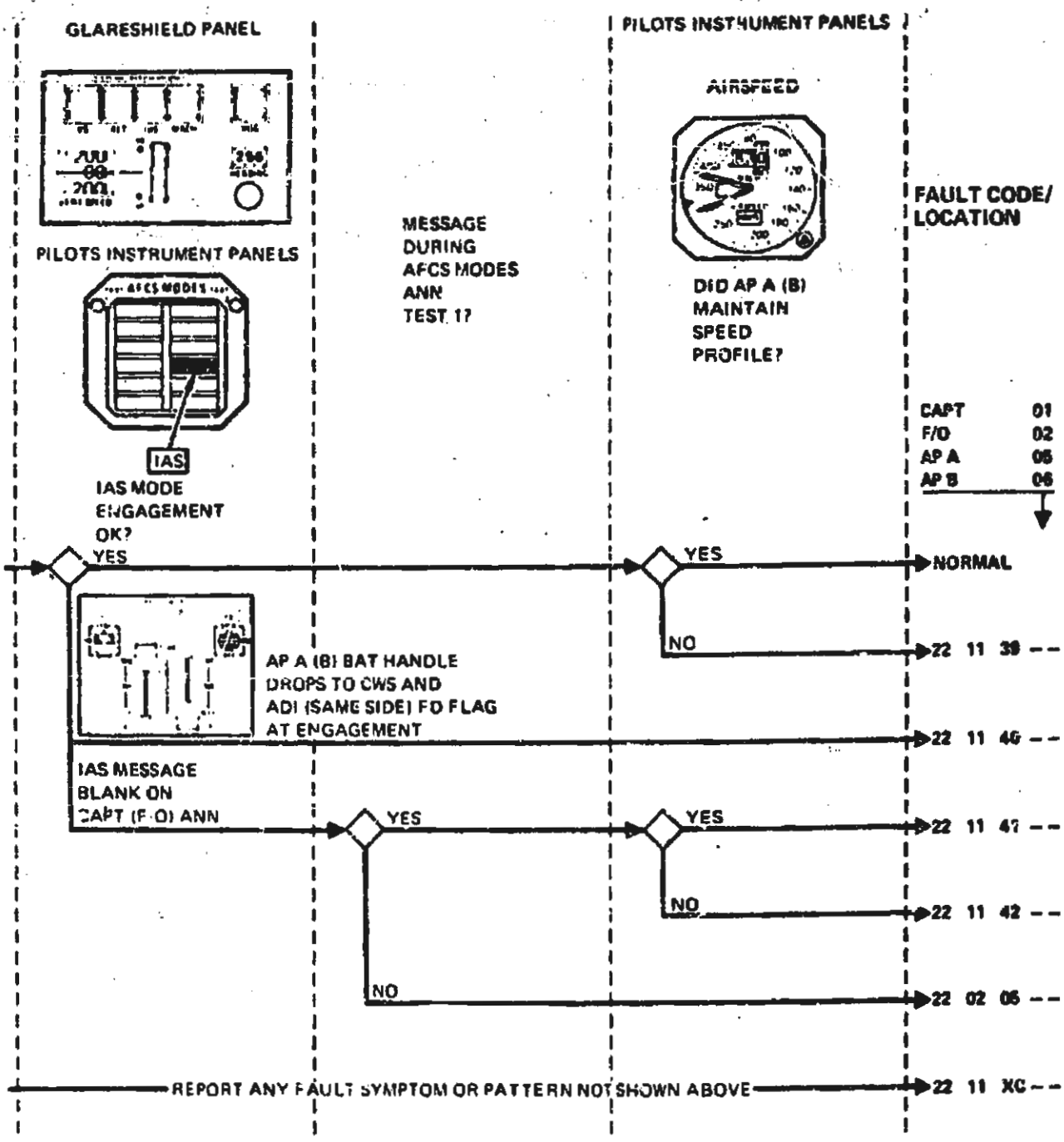
R Autopilot VS Mode - Fault Codes
Figure 9

EFFECTIVITY: ALL

0508

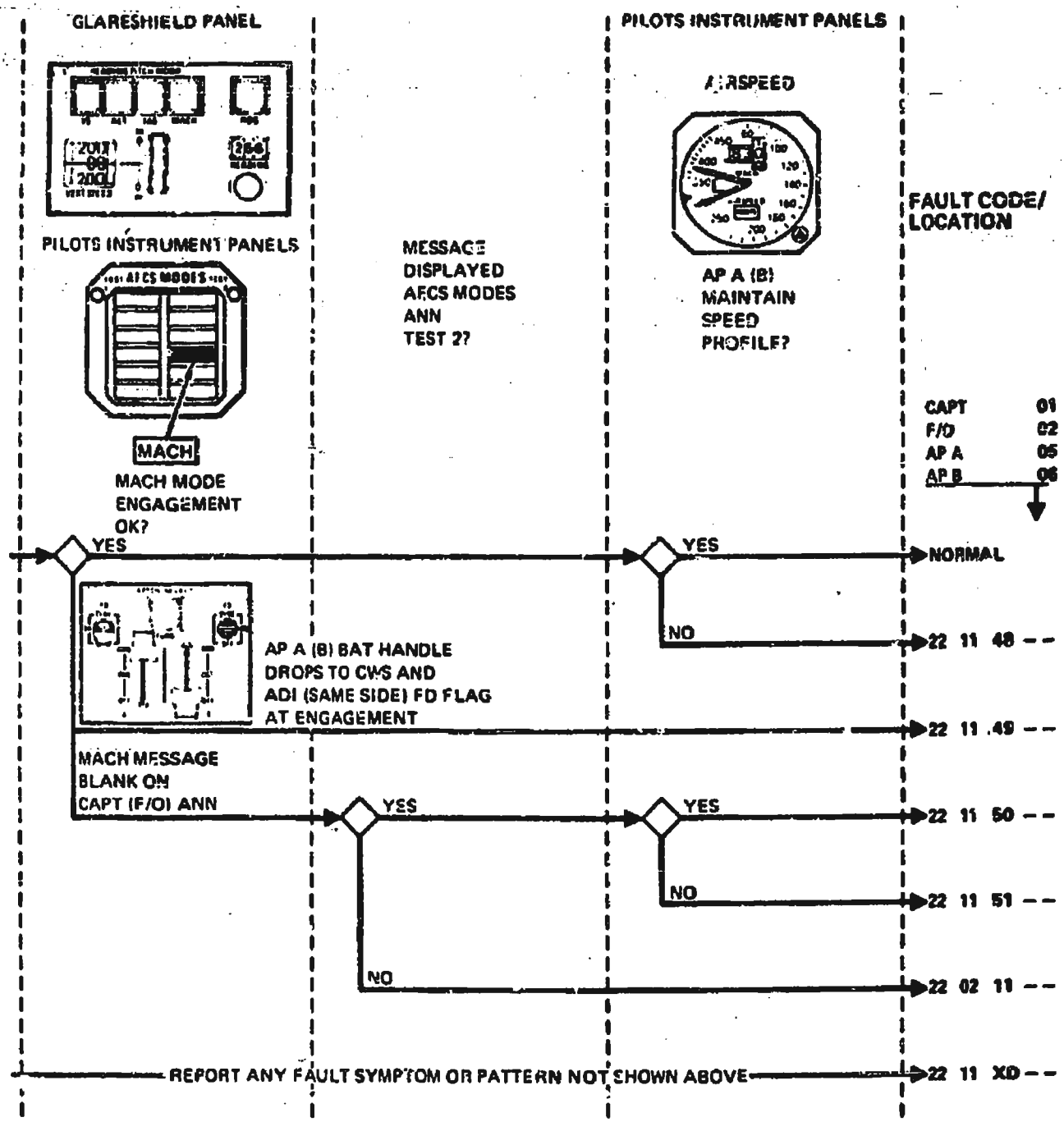

GLARESHIELD PANEL
PILOTS INSTRUMENT PANEL
PILOTS INSTRUMENT PANELS
OFF FLAG
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
NORM 09
STBY 10
AP/FDA 13
AP/FDB 14
NOT APPLY 00
PILOTS INSTRUMENT PANELS
ALT ARM
ALT ARM ENGAGEMENT OK?
YES
GLARESHIELD PANEL
PILOTS INSTRUMENT PANEL
ALT
AP CAPTURE ALTITUDE?
YES
SELECTED ALT CAPTURED AND MAINTAINED?
YES
NORMAL
NO
22 11 21 - -
AP A (B) BAT HANDLE DROPS TO OFF AND ADI (SAME SIDE) FD FLAG AT ALT CAPTURE
22 11 32 - -
FLEW THRU SEL ALT AP/FD A (B) ENG – (OTHER AP OPER OK) 1
22 11 23 - -
FLEW THRU SEL ALT NORM (STBY) SEL – (OPER OK IN OTHER KNOB POS) 1
22 11 24 - -
ALT ARM MESSAGE BLANK ON CAPT (F/O) ANN
22 11 25 - -
ALT ARM MESSAGE DROPS OUT BEFORE CAPTURE – NORM (STBY) SOURCE SEL
22 11 31 - -
WILL NOT ARM – NORM (STBY) SOURCE SEL
22 11 26 - -
WILL NOT ARM BOTH NORM AND STBY SOURCE SEL
22 11 27 00
ARMS MOMENTARILY THEN CAPTURES ALTITUDE
22 11 28 00
ALT KNOB – LOOSE, STUCK, FROZEN
22 11 15 00
FLAG NORM (STBY) SOURCE SEL
WERE SAME SIDE (NORM = 09 STBY = 10) STALL WARN, ATS, DLC/AUTO SPRL, ETC., FAIL LIGHTS ON
YES
22 11 16 - -
BARO ALT OFF FLAG (SAME SIDE)
NO
YES
22 11 17 - -
NO
22 11 18 - -
FLAG BOTH NORM AND STBY SOURCE SEL
22 11 19 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 11 XX - -
1 NOTE
PITCH ATT, VS, IAS, OR MACH HOLD MODES ARE SUPERSEDED AT ALTITUDE CAPTURE. HOWEVER, IF AUTOPILOT OR FD DOES NOT CAPTURE THE SELECTED ALTITUDE, THE ENGAGED PITCH MODE WILL REMAIN ENGAGED.
EQ1-0005-22-169

R Autopilot ALTITUDE SELECT/HOLD Mode - Fault Codes
Figure 10



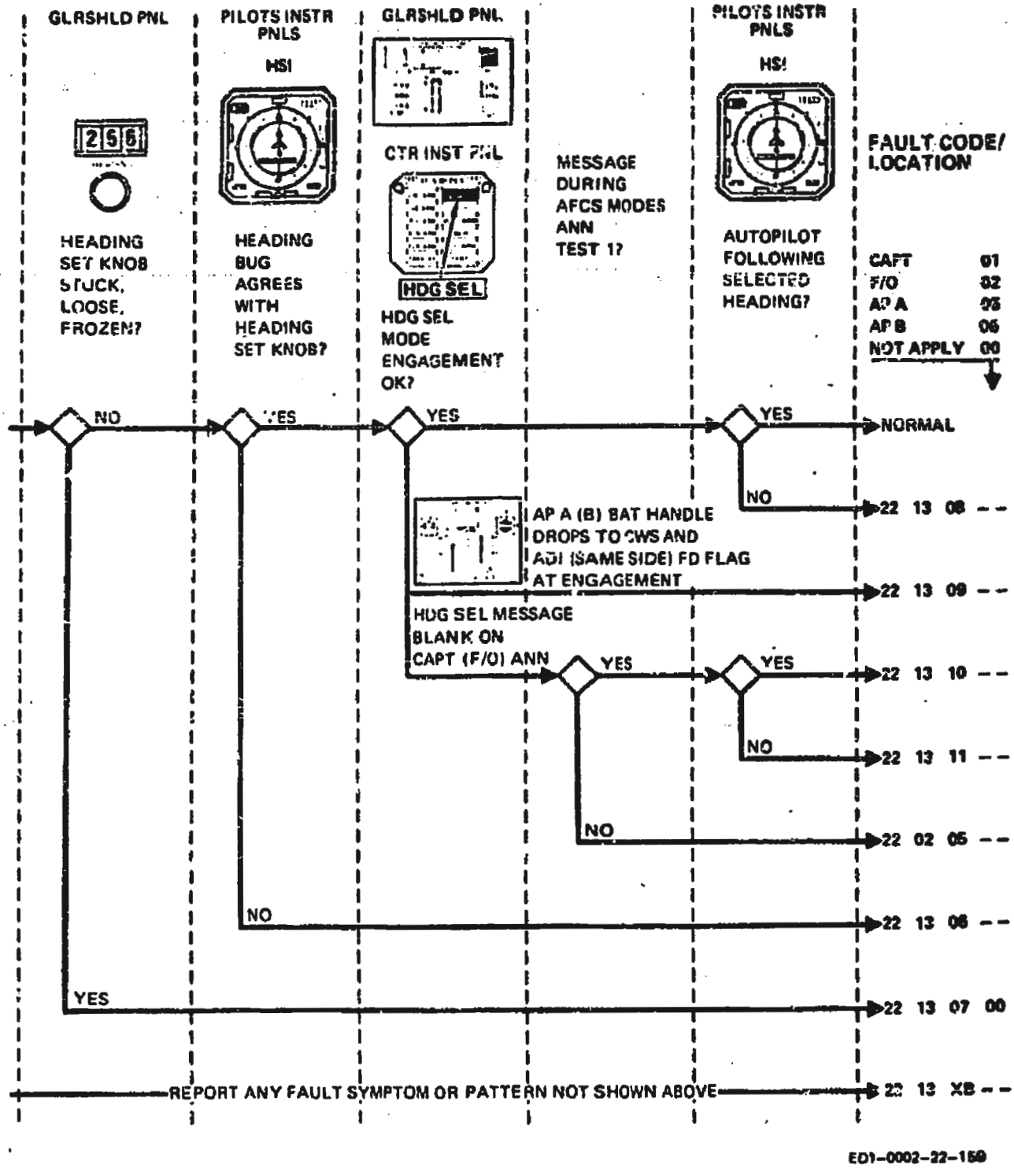
EDI-0002-22-152

R Autopilot IAS Mode - Fault Codes
Figure 11

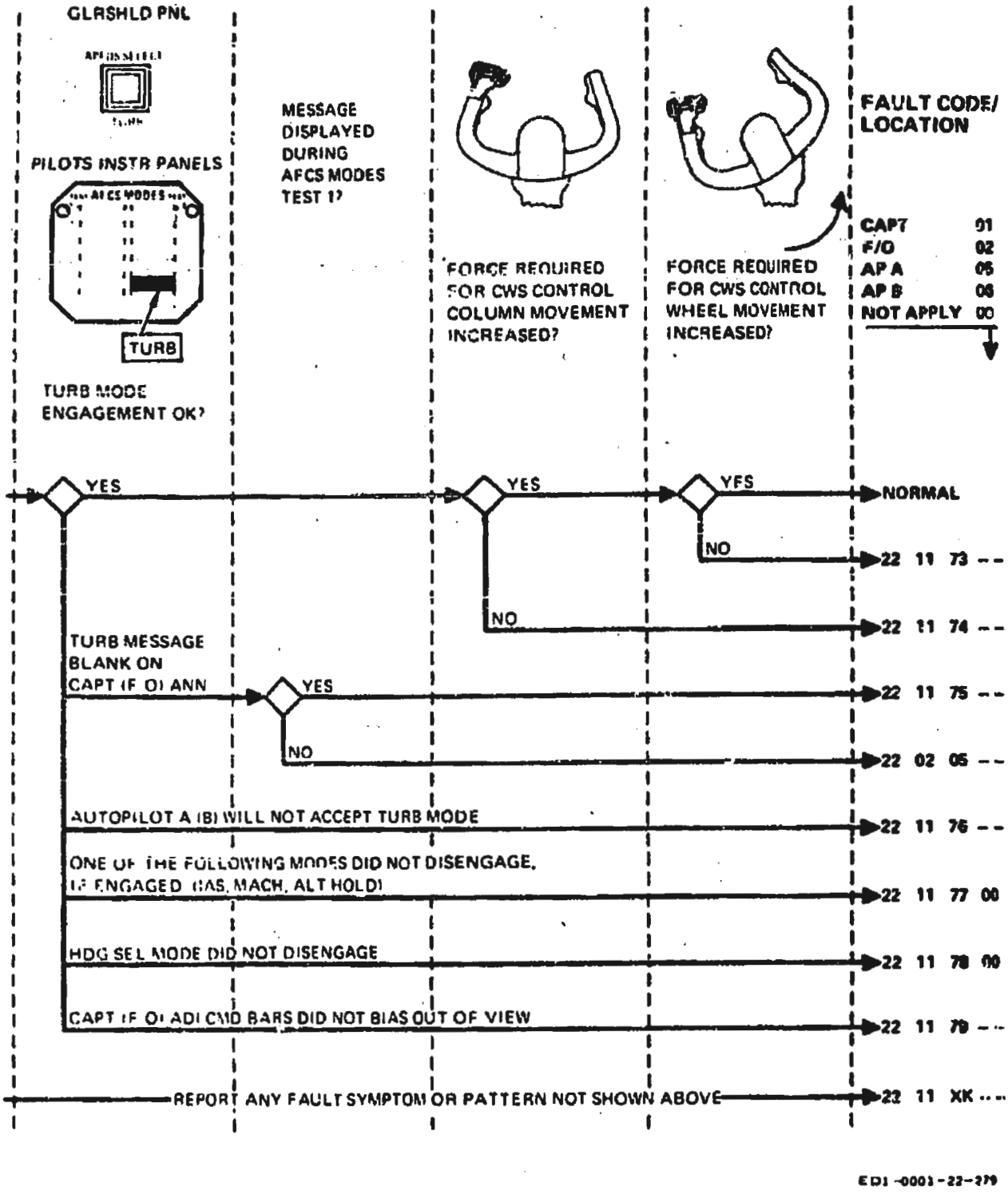


ED1-0002-22-155

R Autopilot MACH Mode - Fault Codes
Figure 12



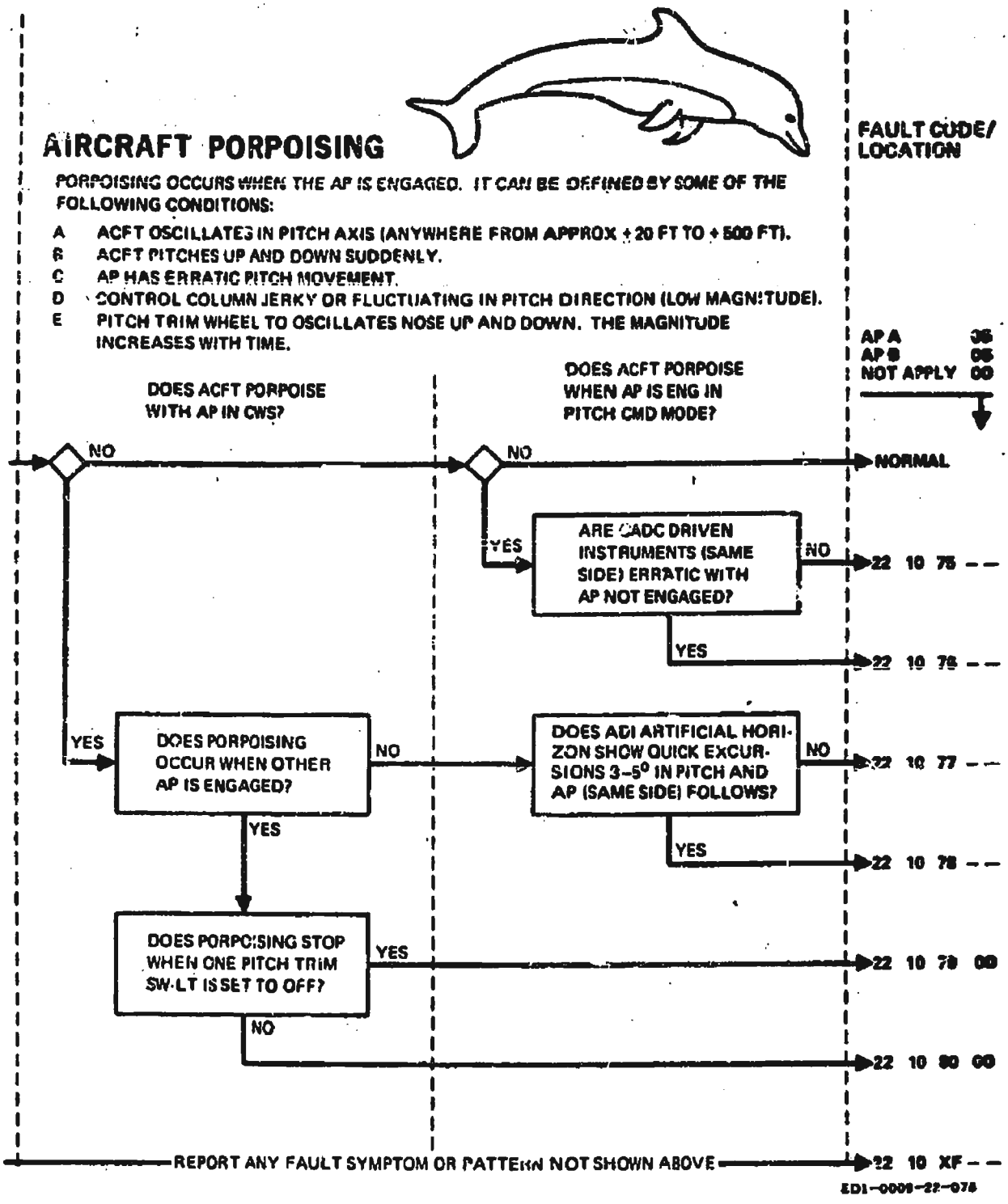
R Autopilot HDG SEL Mode - Fault Codes
Figure 13


GLRSHLD PNL
PILOTS INSTR PANELS
TURB
TURB MODE ENGAGEMENT OK?
MESSAGE DISPLAYED DURING AFCS MODES TEST 1?
FORCE REQUIRED FOR CWS CONTROL COLUMN MOVEMENT INCREASED?
FORCE REQUIRED FOR CWS CONTROL WHEEL MOVEMENT INCREASED?
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
NOT APPLY 00
YES
NO
NORMAL
22 11 73 - -
22 11 74 - -
TURB MESSAGE BLANK ON CAPT (F O) ANN
22 11 75 - -
22 02 05 - -
AUTOPILOT A (B) WILL NOT ACCEPT TURB MODE
22 11 76 - -
ONE OF THE FOLLOWING MODES DID NOT DISENGAGE, IF ENGAGED (IAS, MACH, ALT HOLD)
22 11 77 00
HDG SEL MODE DID NOT DISENGAGE
22 11 78 00
CAPT (F O) ADI CMD BARS DID NOT BIAS OUT OF VIEW
22 11 79 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 11 XK - -
EDI-0001-22-279

R Autopilot Turbulence Mode - Fault Codes
Figure 14

EFFECTIVITY: ALL

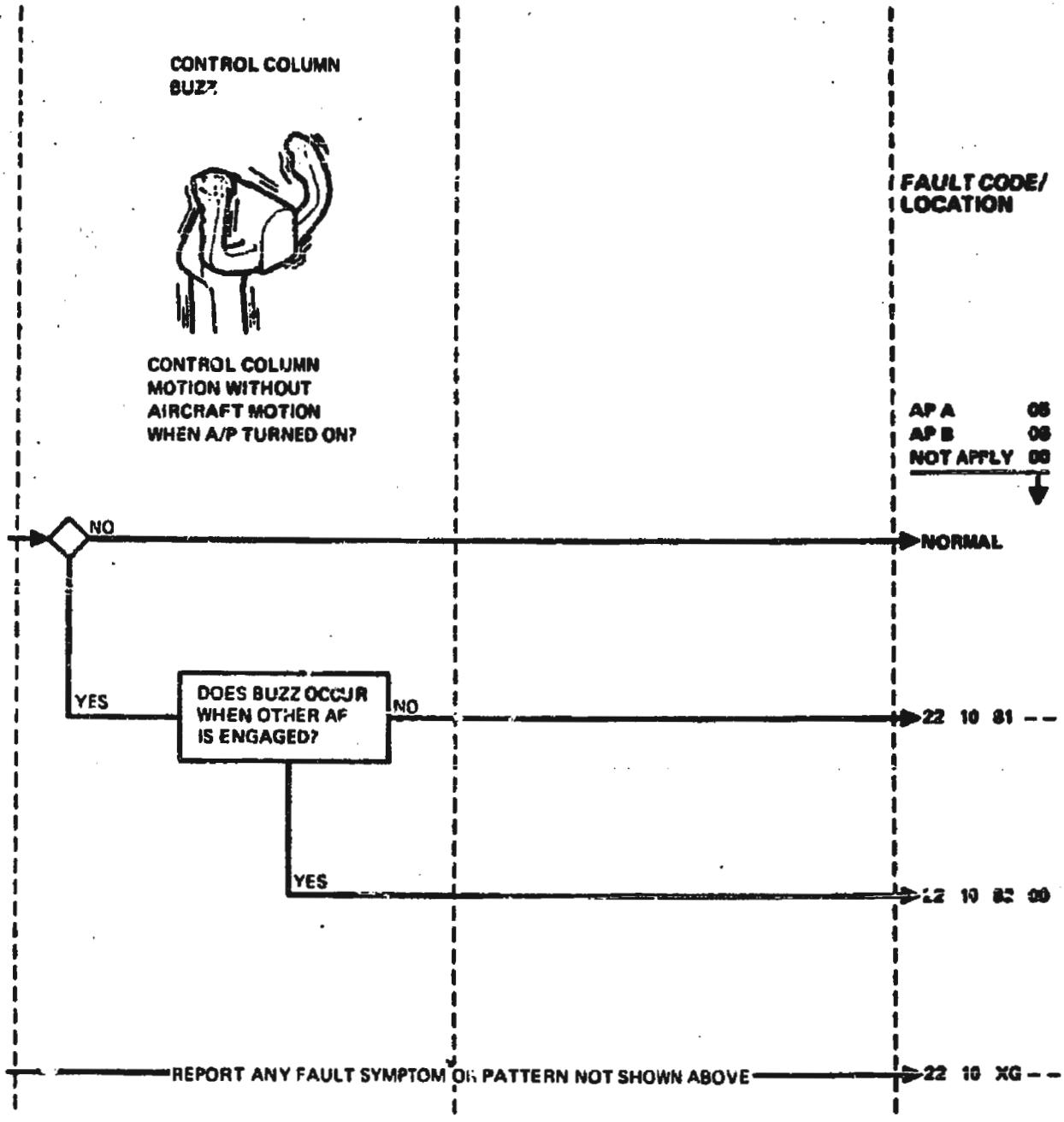
22-FAULT CODE DIAGRAM


AIRCRAFT PORPOISING
PORPOISING OCCURS WHEN THE AP IS ENGAGED. IT CAN BE DEFINED BY SOME OF THE FOLLOWING CONDITIONS:
A ACFT OSCILLATES IN PITCH AXIS (ANYWHERE FROM APPROX +20 FT TO +500 FT).
B ACFT PITCHES UP AND DOWN SUDDENLY.
C AP HAS ERRATIC PITCH MOVEMENT.
D CONTROL COLUMN JERKY OR FLUCTUATING IN PITCH DIRECTION (LOW MAGNITUDE).
E PITCH TRIM WHEEL TO OSCILLATES NOSE UP AND DOWN. THE MAGNITUDE INCREASES WITH TIME.
FAULT CODE/ LOCATION
AP A 35
AP B 05
NOT APPLY 00
DOES ACFT PORPOISE WITH AP IN CWS?
DOES ACFT PORPOISE WHEN AP IS ENG IN PITCH CMD MODE?
NO
NO
NORMAL
YES
ARE ADC DRIVEN INSTRUMENTS (SAME SIDE) ERRATIC WITH AP NOT ENGAGED?
NO
22 10 75 - -
YES
22 10 76 - -
YES
DOES PORPOISING OCCUR WHEN OTHER AP IS ENGAGED?
NO
DOES ADI ARTIFICIAL HORIZON SHOW QUICK EXCURSIONS 3-5° IN PITCH AND AP (SAME SIDE) FOLLOWS?
NO
22 10 77 - -
YES
22 10 78 - -
YES
DOES PORPOISING STOP WHEN ONE PITCH TRIM SWITCH IS SET TO OFF?
YES
22 10 79 00
NO
22 10 80 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 10 XF - -
ED1-0009-22-079

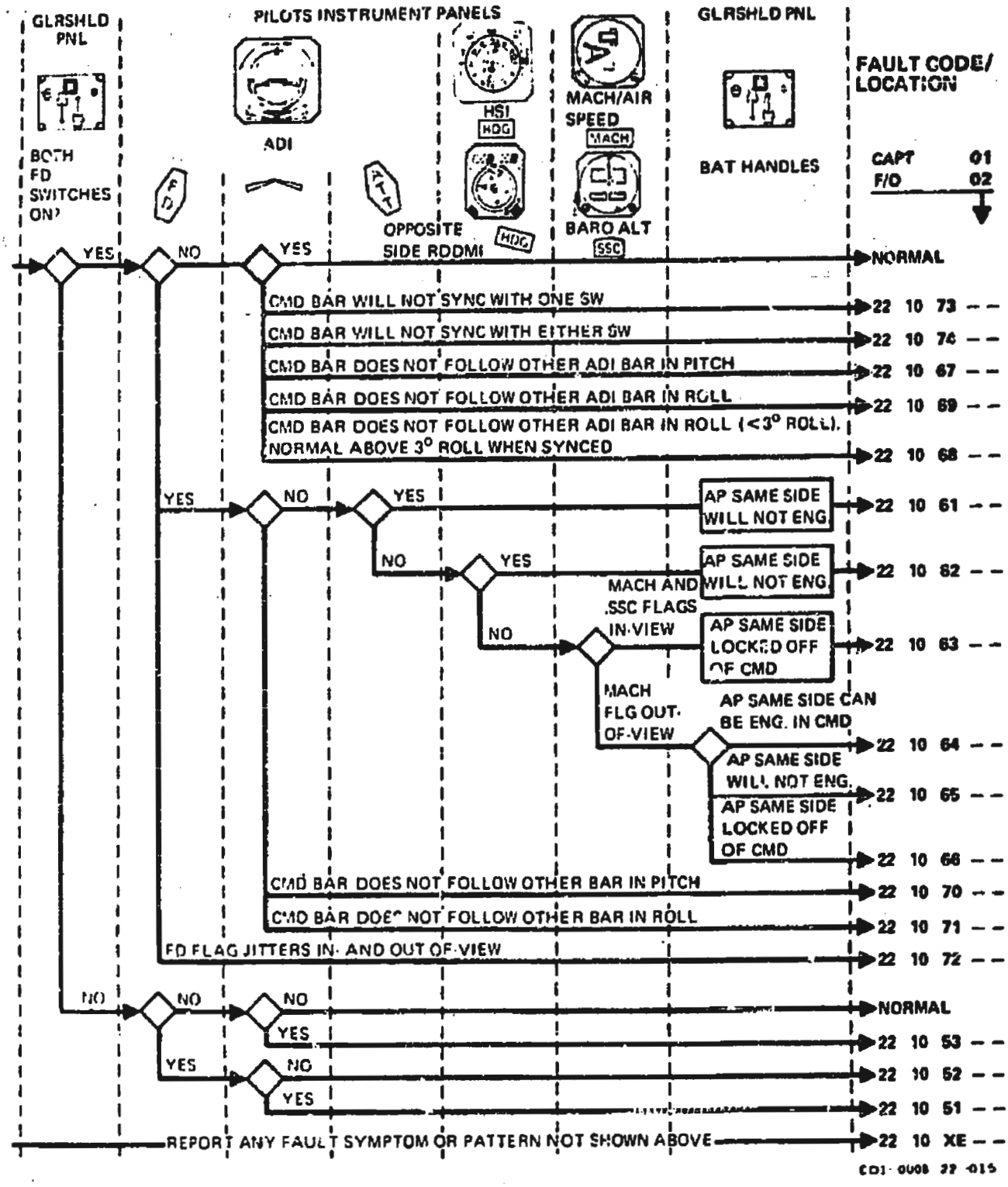
R Aircraft Porpoising with AP - Turned-on - Fault Codes
Figure 15

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM



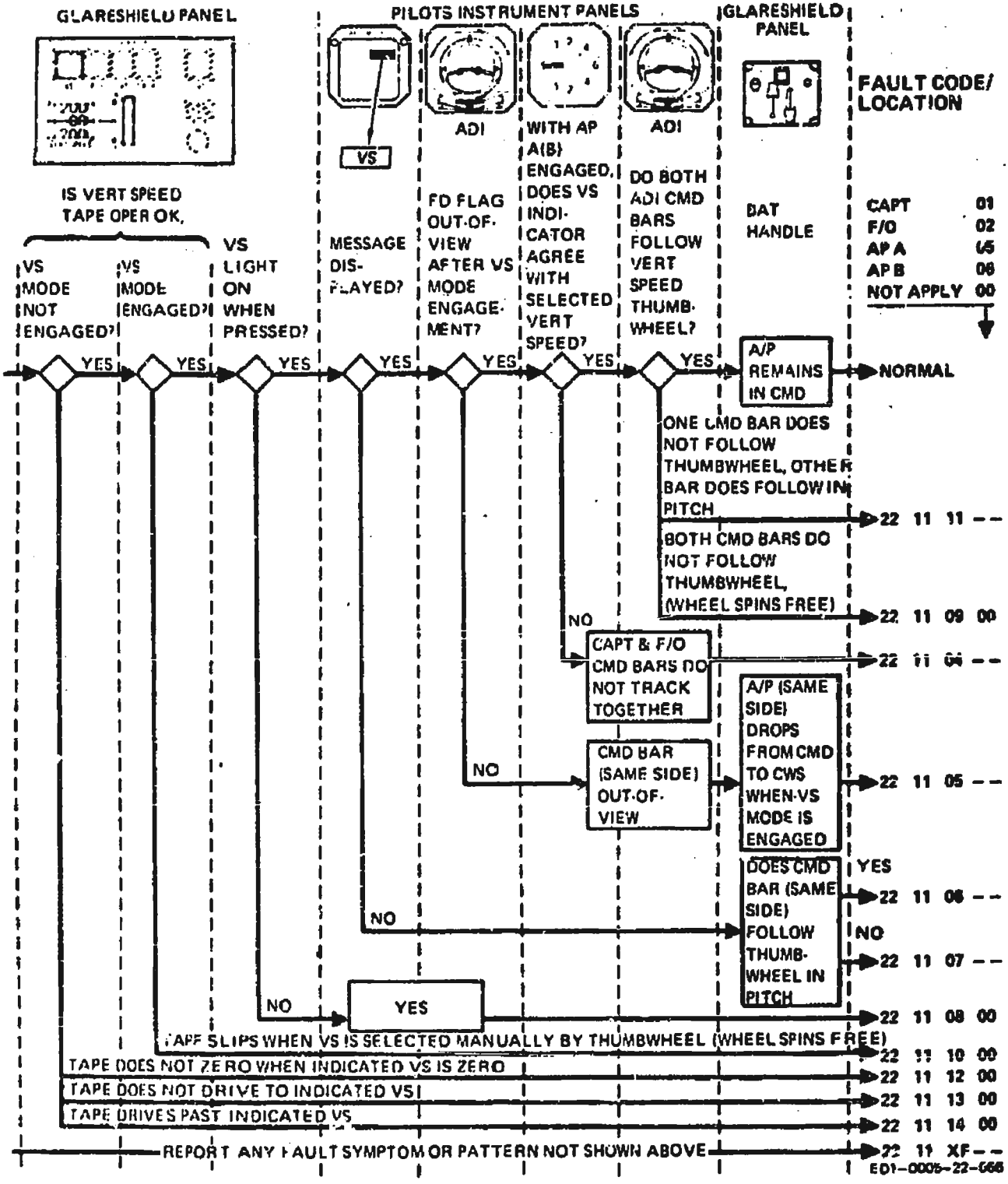
R Control Column Buzz with Autopilot Turned-on - Fault Codes
Figure 16


GLRSHLD PNL
BOTH FD SWITCHES ON?
PILOTS INSTRUMENT PANELS
ADI
HSI
HDG
MACH/AIR SPEED
MACH
OPPOSITE SIDE RDDMI
BARO ALT
SSC
GLRSHLD PNL
BAT HANDLES
FAULT CODE/ LOCATION
CAPT 01
F/O 02
YES
NO
NORMAL
CMD BAR WILL NOT SYNC WITH ONE SW
22 10 73 - -
CMD BAR WILL NOT SYNC WITH EITHER SW
22 10 74 - -
CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN PITCH
22 10 67 - -
CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN ROLL
22 10 69 - -
CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN ROLL (<3° ROLL). NORMAL ABOVE 3° ROLL WHEN SYNCED
22 10 68 - -
AP SAME SIDE WILL NOT ENG
22 10 61 - -
AP SAME SIDE WILL NOT ENG
22 10 62 - -
MACH AND SSC FLAGS IN VIEW
AP SAME SIDE LOCKED OFF OF CMD
22 10 63 - -
MACH FLG OUT-OF-VIEW
AP SAME SIDE CAN BE ENG. IN CMD
22 10 64 - -
AP SAME SIDE WILL NOT ENG.
22 10 65 - -
AP SAME SIDE LOCKED OFF OF CMD
22 10 66 - -
CMD BAR DOES NOT FOLLOW OTHER BAR IN PITCH
22 10 70 - -
CMD BAR DOES NOT FOLLOW OTHER BAR IN ROLL
22 10 71 - -
FD FLAG JITTERS IN AND OUT OF VIEW
22 10 72 - -
NORMAL
22 10 53 - -
22 10 52 - -
22 10 51 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 10 XE - -
CD1-0008 22-015

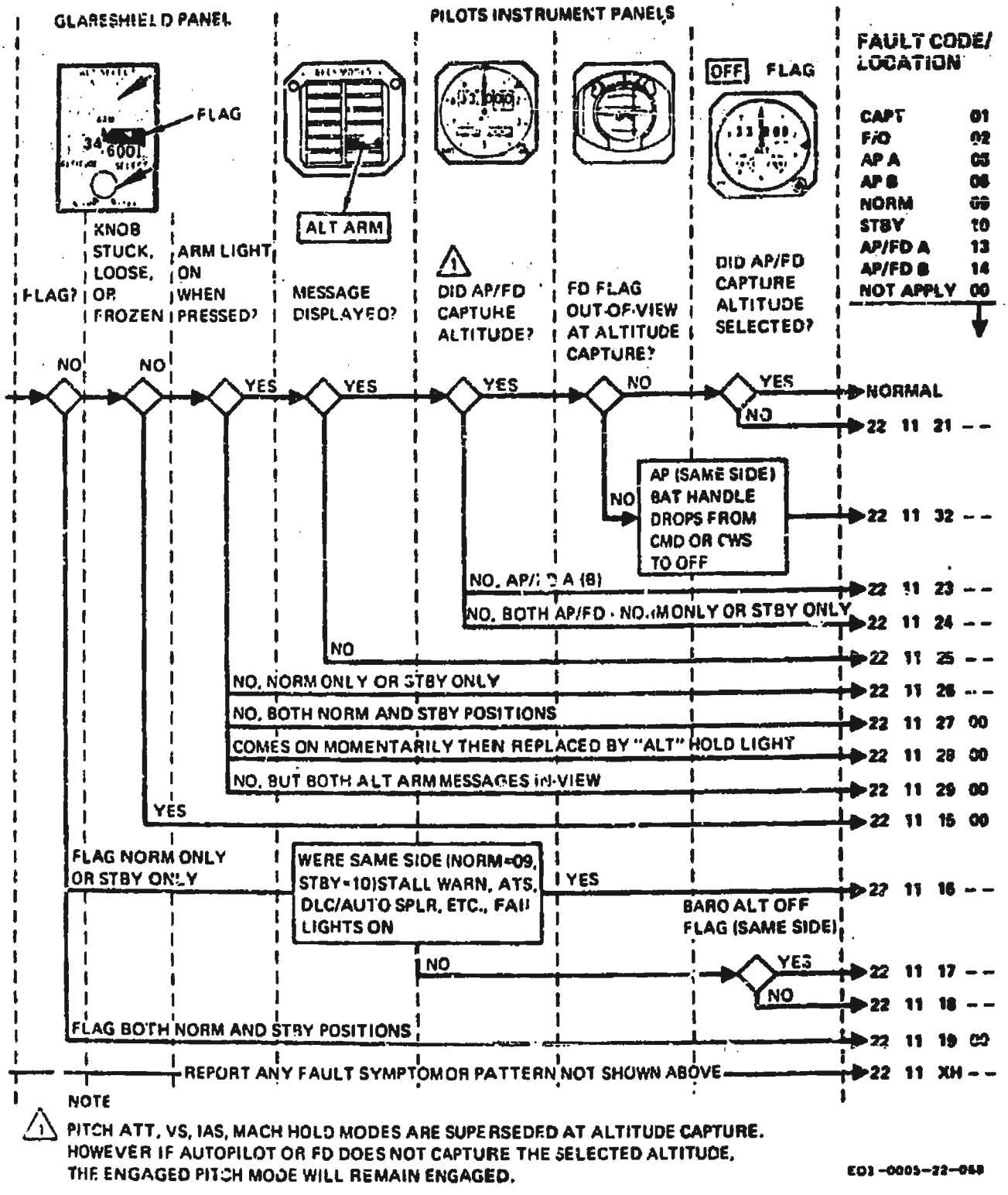
R Flight Director Basic Mode - Fault Codes
Figure 17

EFFECTIVITY: ALL

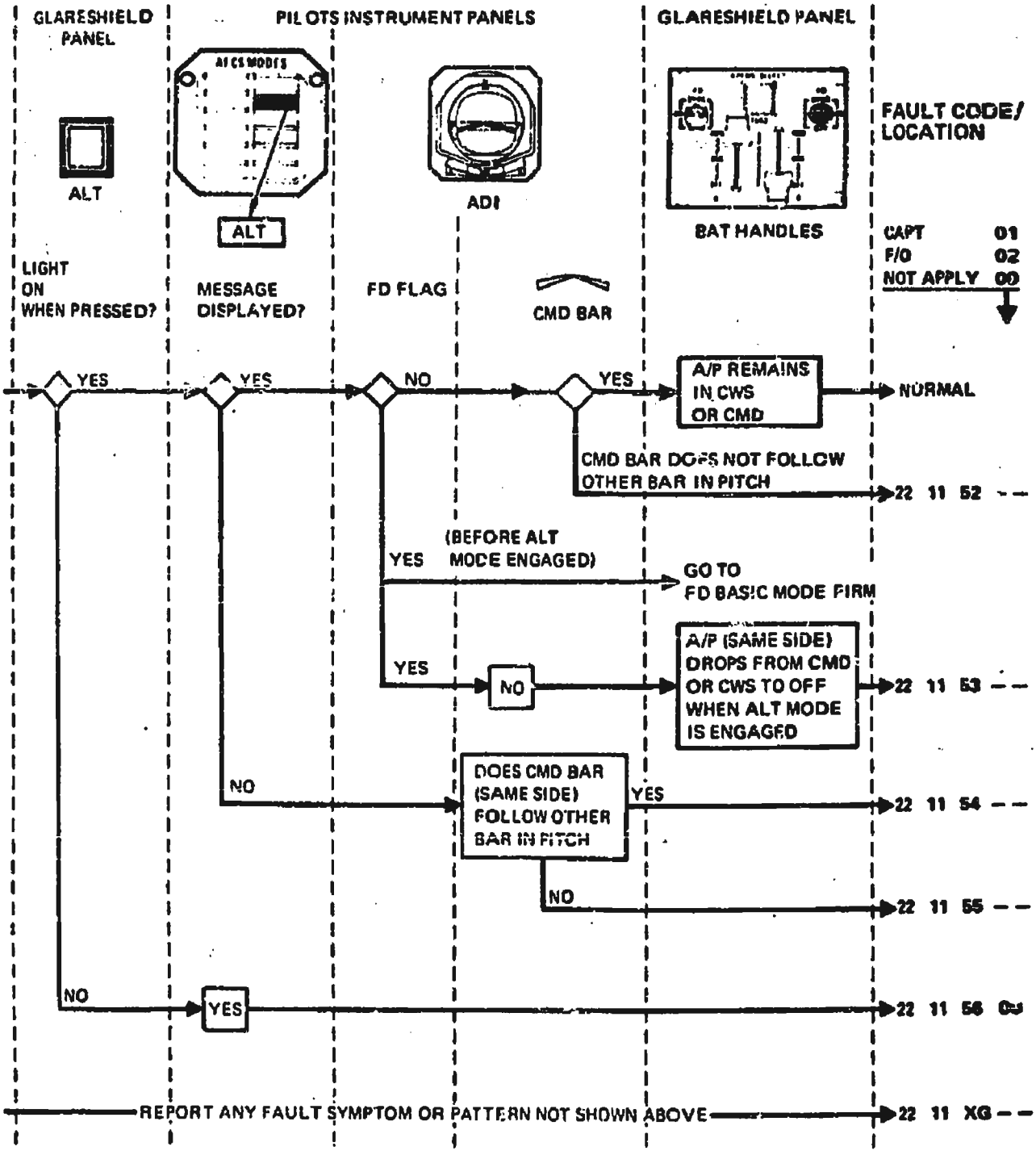
22-FAULT CODE DIAGRAM


GLARESHIELD PANEL
PILOTS INSTRUMENT PANELS
GLARESHIELD PANEL
FAULT CODE/ LOCATION
VS
ADI
ADI
IS VERT SPEED TAPE OPER OK,
VS MODE NOT ENGAGED?
VS MODE ENGAGED?
VS LIGHT ON WHEN PRESSED?
MESSAGE DIS-PLAYED?
FD FLAG OUT-OF-VIEW AFTER VS MODE ENGAGE-MENT?
WITH AP A(B) ENGAGED, DOES VS INDI-CATOR AGREE WITH SELECTED VERT SPEED?
DO BOTH ADI CMD BARS FOLLOW VERT SPEED THUMB-WHEEL?
BAT HANDLE
CAPT 01
F/O 02
AP A 05
AP B 06
NOT APPLY 00
YES
NO
A/P REMAINS IN CMD
NORMAL
ONE CMD BAR DOES NOT FOLLOW THUMBWHEEL, OTHER BAR DOES FOLLOW IN PITCH
22 11 11 - -
BOTH CMD BARS DO NOT FOLLOW THUMBWHEEL, (WHEEL SPINS FREE)
22 11 09 00
CAPT & F/O CMD BARS DO NOT TRACK TOGETHER
22 11 04 - -
CMD BAR (SAME SIDE) OUT-OF-VIEW
A/P (SAME SIDE) DROPS FROM CMD TO CWS WHEN VS MODE IS ENGAGED
22 11 05 - -
DOES CMD BAR (SAME SIDE) FOLLOW THUMB-WHEEL IN PITCH
22 11 06 - -
22 11 07 - -
22 11 08 00
TAPE SLIPS WHEN VS IS SELECTED MANUALLY BY THUMBWHEEL (WHEEL SPINS FREE)
22 11 10 00
TAPE DOES NOT ZERO WHEN INDICATED VS IS ZERO
22 11 12 00
TAPE DOES NOT DRIVE TO INDICATED VS
22 11 13 00
TAPE DRIVES PAST INDICATED VS
22 11 14 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 11 XF - -
ED1-0005-22-066

R Flight Director VS Hold Mode - Fault Codes
Figure 18


GLARESHIELD PANEL
PILOTS INSTRUMENT PANELS
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
NORM 09
STBY 10
AP/FD A 13
AP/FD B 14
NOT APPLY 00
FLAG
OFF FLAG
ALT ARM
FLAG?
KNOB STUCK, LOOSE, OR FROZEN
ARM LIGHT ON WHEN PRESSED?
MESSAGE DISPLAYED?
DID AP/FD CAPTURE ALTITUDE?
FD FLAG OUT-OF-VIEW AT ALTITUDE CAPTURE?
DID AP/FD CAPTURE ALTITUDE SELECTED?
NO
YES
NORMAL
22 11 21 - -
AP (SAME SIDE) BAT HANDLE DROPS FROM CMD OR CWS TO OFF
22 11 32 - -
NO, AP/FD A (B)
22 11 23 - -
NO, BOTH AP/FD - NORM ONLY OR STBY ONLY
22 11 24 - -
22 11 25 - -
NO, NORM ONLY OR STBY ONLY
22 11 26 - -
NO, BOTH NORM AND STBY POSITIONS
22 11 27 00
COMES ON MOMENTARILY THEN REPLACED BY "ALT" HOLD LIGHT
22 11 28 00
NO, BUT BOTH ALT ARM MESSAGES in-VIEW
22 11 29 00
22 11 15 00
FLAG NORM ONLY OR STBY ONLY
WERE SAME SIDE (NORM=09, STBY=10) STALL WARN, ATS, DLC/AUTO SPLR, ETC., FAIL LIGHTS ON
22 11 16 - -
BARO ALT OFF FLAG (SAME SIDE)
22 11 17 - -
22 11 18 - -
FLAG BOTH NORM AND STBY POSITIONS
22 11 19 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 11 XH - -
NOTE
1 PITCH ATT, VS, IAS, MACH HOLD MODES ARE SUPERSEDED AT ALTITUDE CAPTURE. HOWEVER IF AUTOPILOT OR FD DOES NOT CAPTURE THE SELECTED ALTITUDE, THE ENGAGED PITCH MODE WILL REMAIN ENGAGED.
ED1-0005-22-058

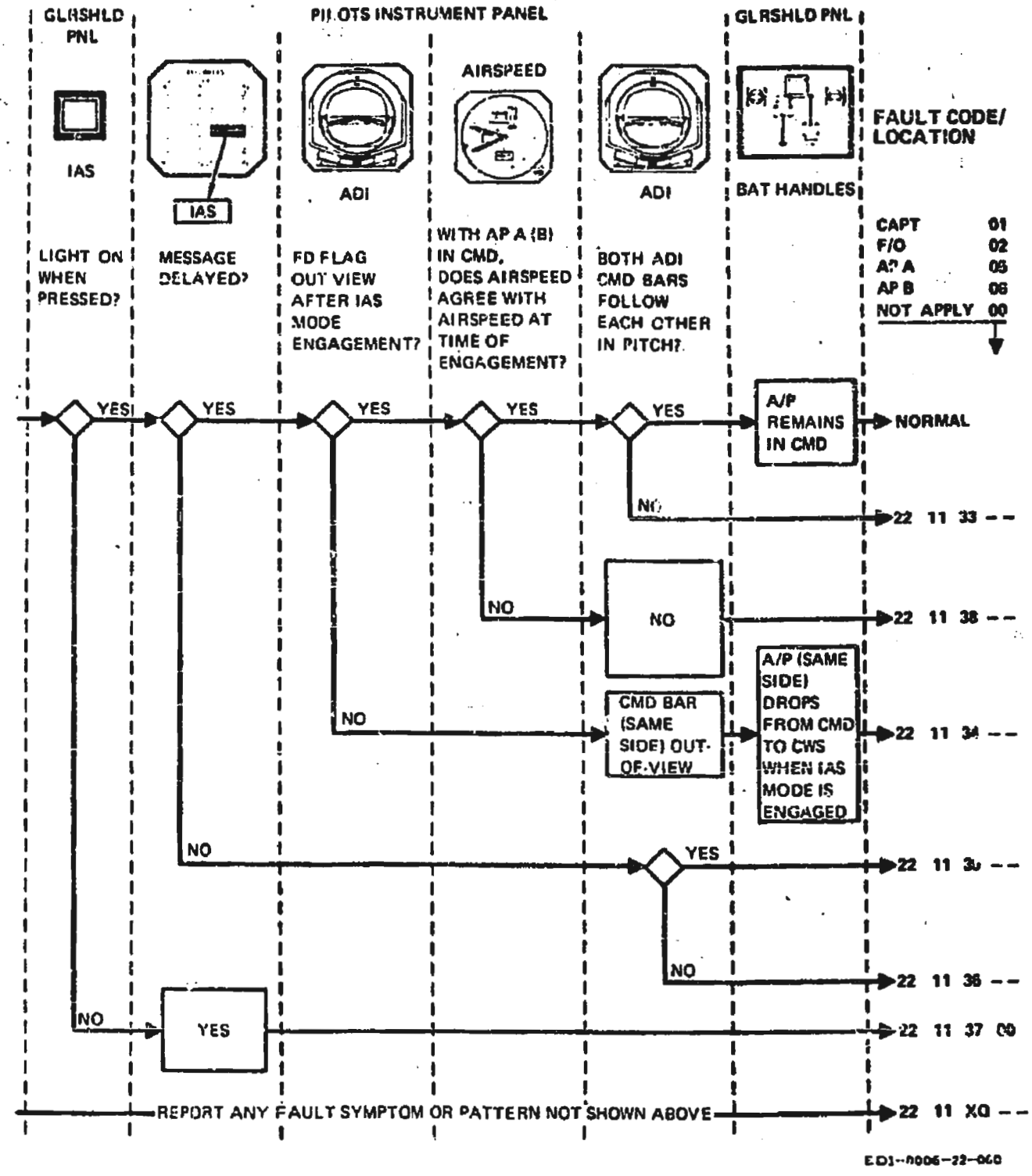
R Flight Director Altitude Select (ALT ARM) Mode - Fault Codes
Figure 19



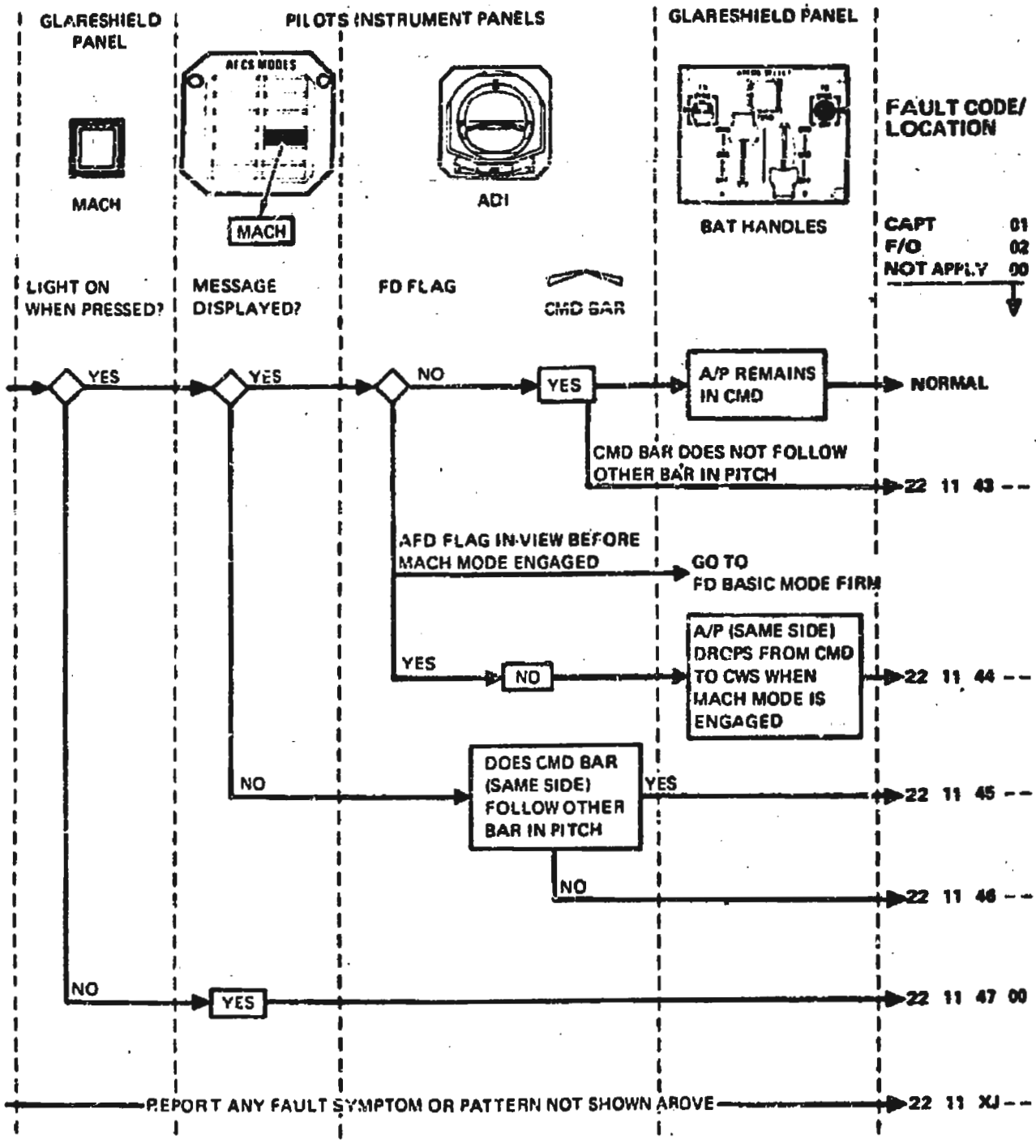
R Flight Director Altitude Hold Mode - Fault Codes
Figure 20

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM

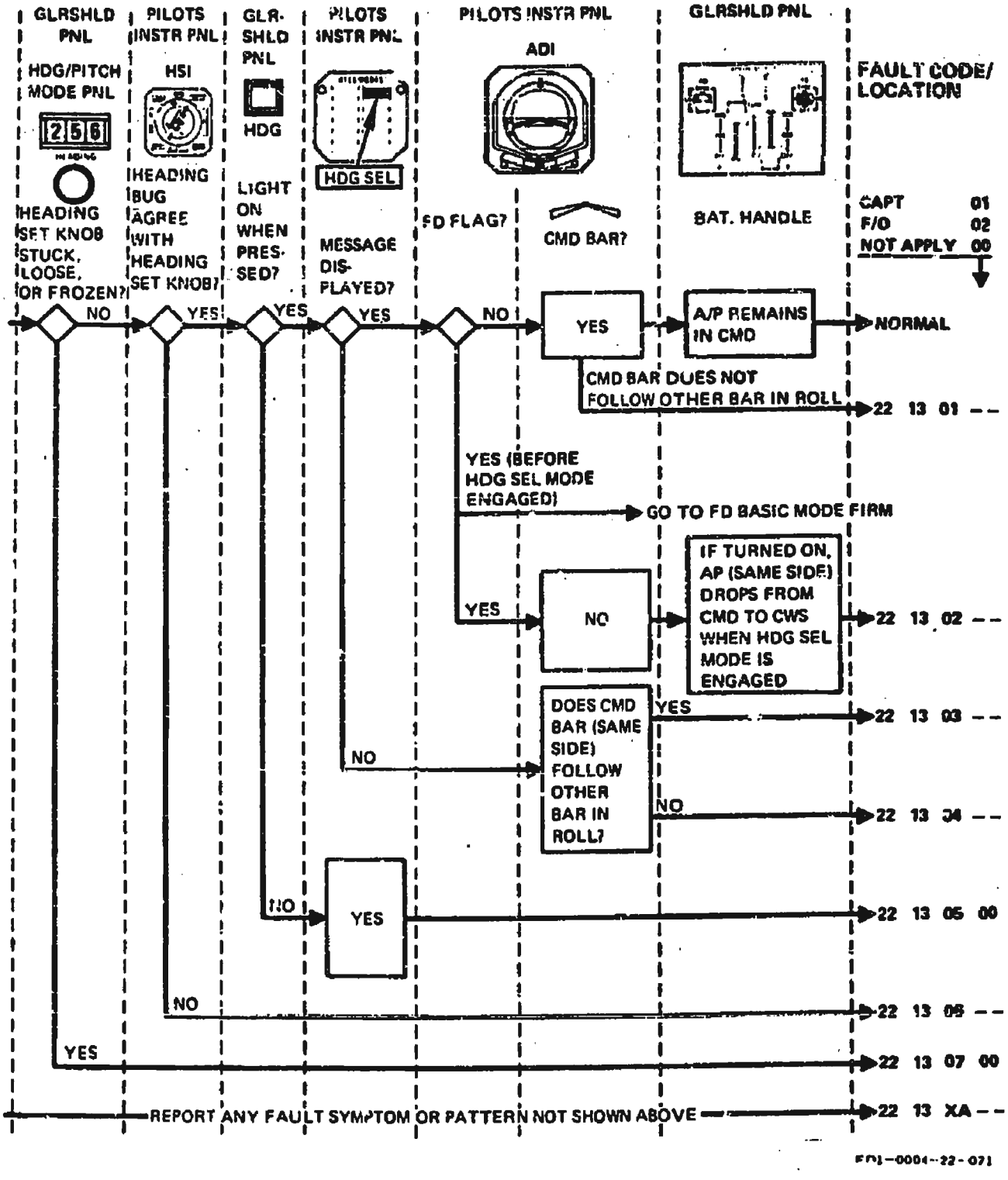


R Flight Director IAS Hold Mode - Fault Codes
Figure 21

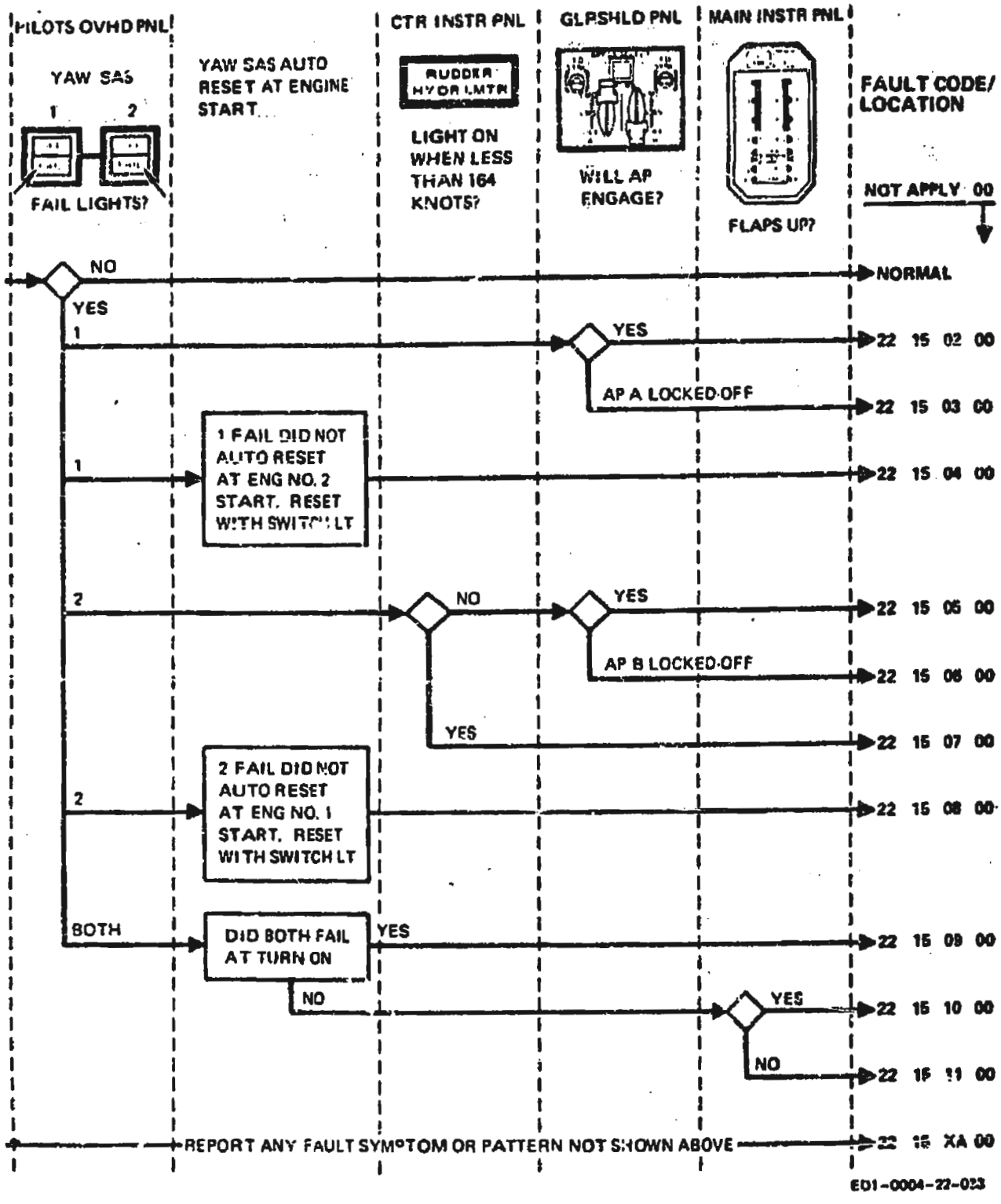


ED1-0003-22-062

R Flight Director MACH Hold Mode - Fault Codes
Figure 22

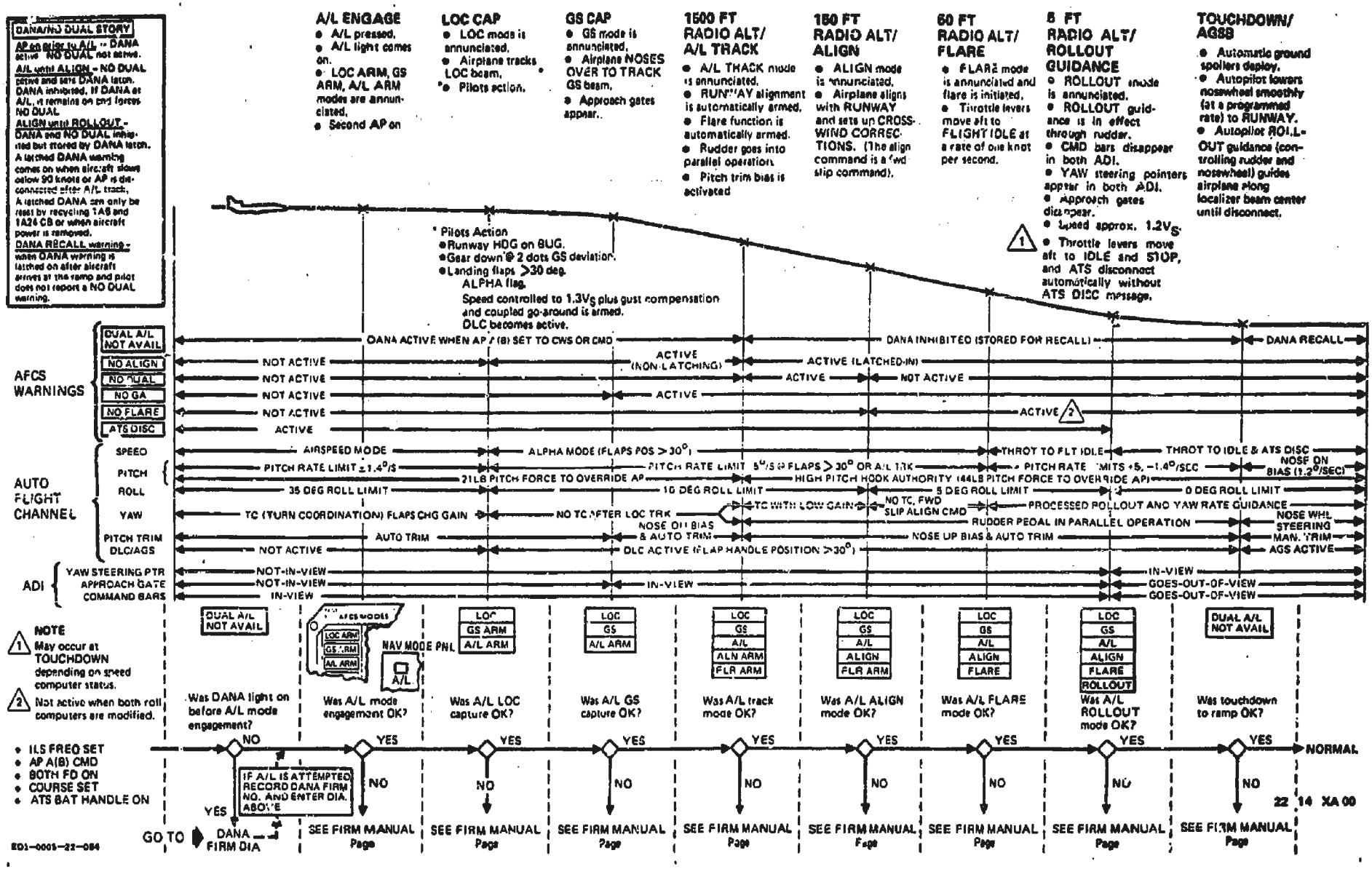


R Flight Director Heading Select Mode - Fault Codes
Figure 23



R YAW SAS FAIL Light - Fault Codes
Figure 24

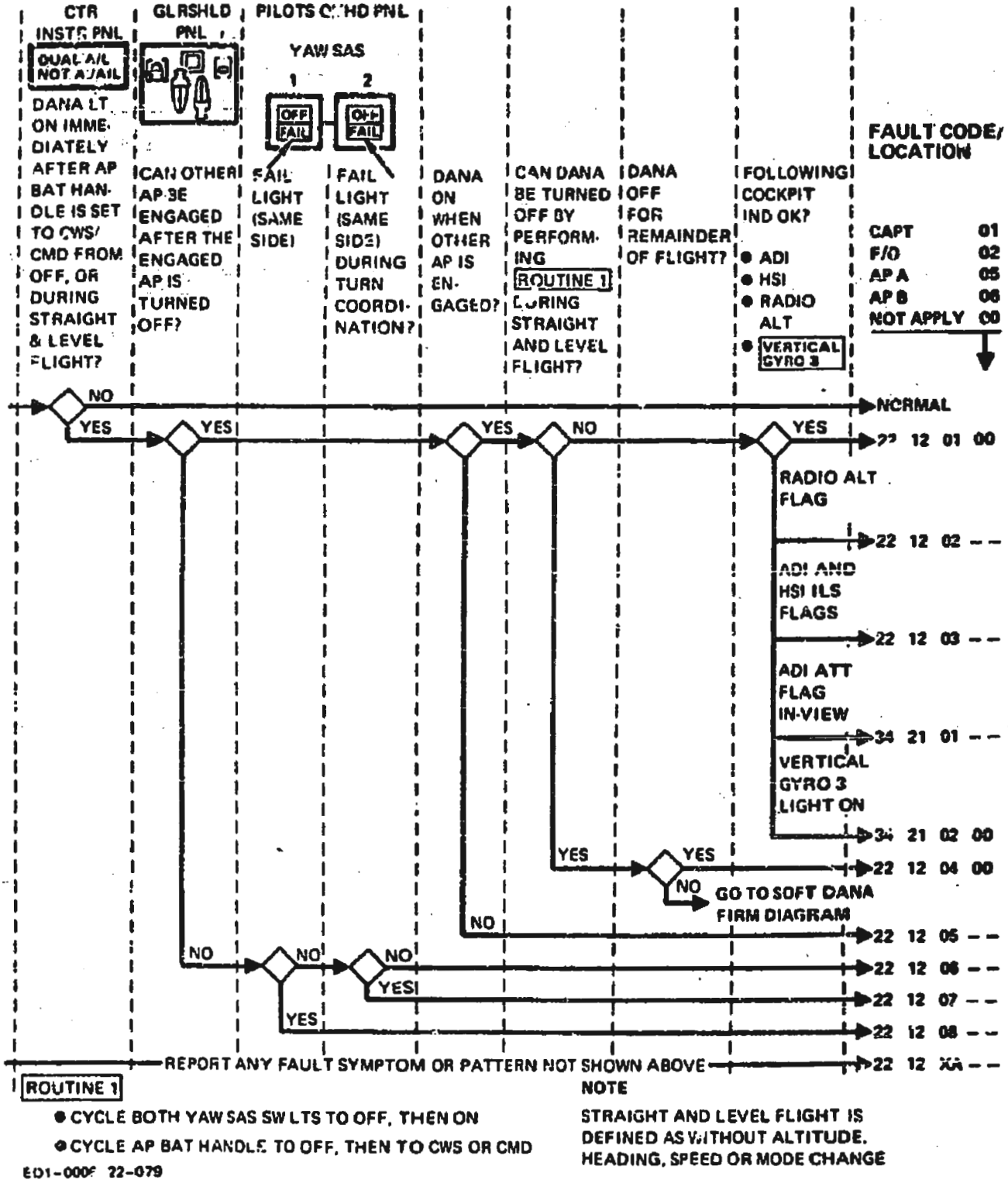
EFFECTIVITY: ALL


DANA/NO DUAL STORY
AP engage to A/L - DANA active NO DUAL not active.
A/L until ALIGN - NO DUAL active and sets DANA latch. DANA inhibited. If DANA at A/L, it remains on and forces NO DUAL
ALIGN until ROLLOUT - DANA and NO DUAL inhibited but stored by DANA latch.
A latched DANA warning comes on when aircraft slows below 90 knots or AP is disconnected after A/L track.
A latched DANA can only be reset by recycling 1AS and 1A24 CB or when aircraft power is removed.
DANA RECALL warning - when DANA warning is latched on after aircraft arrives at the ramp and pilot does not report a NO DUAL warning.
A/L ENGAGE
• A/L pressed.
• A/L light comes on.
• LOC ARM, GS ARM, A/L ARM modes are annunciated.
• Second AP on
LOC CAP
• LOC mode is annunciated.
• Airplane tracks LOC beam.
• Pilots action.
GS CAP
• GS mode is annunciated.
• Airplane NOSES OVER TO TRACK GS beam.
• Approach gates appear.
1500 FT RADIO ALT/ A/L TRACK
• A/L TRACK mode is annunciated.
• RUNWAY alignment is automatically armed.
• Flare function is automatically armed.
• Rudder goes into parallel operation.
• Pitch trim bias is activated
150 FT RADIO ALT/ ALIGN
• ALIGN mode is annunciated.
• Airplane aligns with RUNWAY and sets up CROSS-WIND CORRECTIONS. (The align command is a fwd slip command).
60 FT RADIO ALT/ FLARE
• FLARE mode is annunciated and flare is initiated.
• Throttle levers move aft to FLIGHT IDLE at a rate of one knot per second.
8 FT RADIO ALT/ ROLLOUT GUIDANCE
• ROLLOUT mode is annunciated.
• ROLLOUT guidance is in effect through rudder.
• CMD bars disappear in both ADI.
• YAW steering pointers appear in both ADI.
• Approach gates disappear.
• Speed approx. 1.2Vs.
• Throttle levers move aft to IDLE and STOP, and ATS disconnect automatically without ATS DISC message.
TOUCHDOWN/ AGSS
• Automatic ground spoilers deploy.
• Autopilot lowers nosewheel smoothly (at a programmed rate) to RUNWAY.
• Autopilot ROLLOUT guidance (controlling rudder and nosewheel) guides airplane along localizer beam center until disconnect.
* Pilots Action
•Runway HDG on BUG.
•Gear down @ 2 dots GS deviation.
•Landing flaps >30 deg.
ALPHA flag.
Speed controlled to 1.3Vs plus gust compensation and coupled go-around is armed.
DLC becomes active.
AFCS WARNINGS
DUAL A/L NOT AVAIL
NO ALIGN
NO DUAL
NO GA
NO FLARE
ATS DISC
AUTO FLIGHT CHANNEL
SPEED
PITCH
ROLL
YAW
PITCH TRIM DLC/AGS
ADI
YAW STEERING PTR
APPROACH GATE
COMMAND BARS
DANA ACTIVE WHEN AP A (B) SET TO CWS OR CMD
DANA INHIBITED (STORED FOR RECALL)
DANA RECALL
NOT ACTIVE
ACTIVE (NON-LATCHING)
ACTIVE (LATCHED-IN)
ACTIVE
AIRSPEED MODE
ALPHA MODE (FLAPS POS >30°)
THROT TO FLT IDLE
THROT TO IDLE & ATS DISC
PITCH RATE LIMIT ±1.4°/S
PITCH RATE LIMIT 5°/S @ FLAPS >30° OR A/L TRK
PITCH RATE LIMITS +5, -1.4°/SEC
NOSE DN BIAS (1.2°/SEC)
21 LB PITCH FORCE TO OVERRIDE AP
HIGH PITCH HOOK AUTHORITY (44LB PITCH FORCE TO OVERRIDE AP)
35 DEG ROLL LIMIT
10 DEG ROLL LIMIT
5 DEG ROLL LIMIT
0 DEG ROLL LIMIT
TC (TURN COORDINATION) FLAPS CHG GAIN
NO TC AFTER LOC TRK
TC WITH LOW GAIN
NO TC, FWD SLIP ALIGN CMD
PROCESSED ROLLOUT AND YAW RATE GUIDANCE
NOSE OFF BIAS & AUTO TRIM
RUDDER PEDAL IN PARALLEL OPERATION
NOSE WHL STEERING
AUTO TRIM
NOSE UP BIAS & AUTO TRIM
MAN. TRIM
NOT ACTIVE
DLC ACTIVE (FLAP HANDLE POSITION >30°)
AGS ACTIVE
NOT-IN-VIEW
IN-VIEW
GOES-OUT-OF-VIEW
NOTE
1 May occur at TOUCHDOWN depending on speed computer status.
2 Not active when both roll computers are modified.
• ILS FREQ SET
• AP A(B) CMD
• BOTH FD ON
• COURSE SET
• ATS BAT HANDLE ON
NAV MODE PNL
A/L
Was DANA light on before A/L mode engagement?
Was A/L mode engagement OK?
Was A/L LOC capture OK?
Was A/L GS capture OK?
Was A/L track mode OK?
Was A/L ALIGN mode OK?
Was A/L FLARE mode OK?
Was A/L ROLLOUT mode OK?
Was touchdown to ramp OK?
NO
YES
IF A/L IS ATTEMPTED RECORD DANA FIRM NO. AND ENTER DIA. ABOVE
GO TO DANA FIRM DIA
SEE FIRM MANUAL Page
NORMAL
ED1-0001-22-084
22 14 XA 00

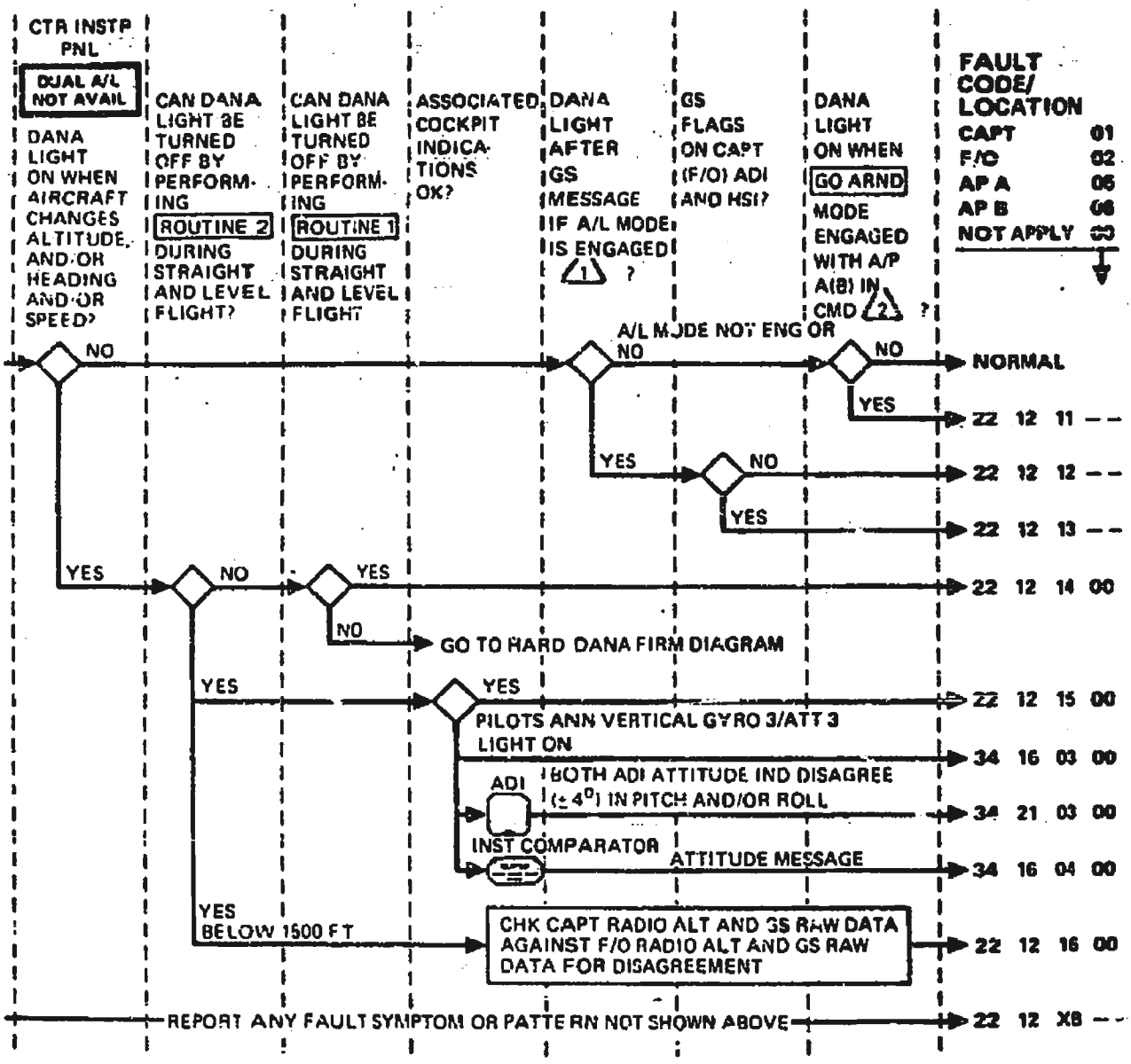
AUTOLAND Overview - Fault Codes
Figure 25

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM


CTR INSTR PNL
GLRSHLD PNL
PILOTS OVHD PNL
DUAL A/L NOT AVAIL
YAW SAS
1
2
OFF FAIL
OFF FAIL
DANA LT ON IMMEDIATELY AFTER AP BAT HANDLE IS SET TO CWS/CMD FROM OFF, OR DURING STRAIGHT & LEVEL FLIGHT?
CAN OTHER AP BE ENGAGED AFTER THE ENGAGED AP IS TURNED OFF?
FAIL LIGHT (SAME SIDE)
FAIL LIGHT (SAME SIDE) DURING TURN COORDINATION?
DANA ON WHEN OTHER AP IS ENGAGED?
CAN DANA BE TURNED OFF BY PERFORMING ROUTINE 1 DURING STRAIGHT AND LEVEL FLIGHT?
DANA OFF FOR REMAINDER OF FLIGHT?
FOLLOWING COCKPIT IND OK?
ADI
HSI
RADIO ALT
VERTICAL GYRO 3
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
NOT APPLY 00
NO
YES
NORMAL
RADIO ALT FLAG
22 12 02 - -
ADI AND HSI ILS FLAGS
22 12 03 - -
ADI ATT FLAG IN-VIEW
34 21 01 - -
VERTICAL GYRO 3 LIGHT ON
34 21 02 00
22 12 04 00
GO TO SOFT DANA FIRM DIAGRAM
22 12 05 - -
22 12 06 - -
22 12 07 - -
22 12 08 - -
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 12 XX - -
ROUTINE 1
• CYCLE BOTH YAW SAS SW LTS TO OFF, THEN ON
• CYCLE AP BAT HANDLE TO OFF, THEN TO CWS OR CMD
NOTE
STRAIGHT AND LEVEL FLIGHT IS DEFINED AS WITHOUT ALTITUDE, HEADING, SPEED OR MODE CHANGE
ED1-000F 22-079

R Hard DANA (Light Comes On Immediately After
R AP Is Engaged or During Straight and Level Flight) - Fault Codes
Figure 26


CTR INSTR PNL
DUAL A/L NOT AVAIL
DANA LIGHT ON WHEN AIRCRAFT CHANGES ALTITUDE, AND/OR HEADING AND/OR SPEED?
CAN DANA LIGHT BE TURNED OFF BY PERFORMING ROUTINE 2 DURING STRAIGHT AND LEVEL FLIGHT?
CAN DANA LIGHT BE TURNED OFF BY PERFORMING ROUTINE 1 DURING STRAIGHT AND LEVEL FLIGHT
ASSOCIATED COCKPIT INDICATIONS OK?
DANA LIGHT AFTER GS MESSAGE IF A/L MODE IS ENGAGED (1) ?
GS FLAGS ON CAPT (F/O) ADI AND HSI?
DANA LIGHT ON WHEN GO ARND MODE ENGAGED WITH A/P A(B) IN CMD (2) ?
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
NOT APPLY 00
A/L MODE NOT ENG OR
NO
YES
NORMAL
22 12 11 - -
22 12 12 - -
22 12 13 - -
22 12 14 00
GO TO HARD DANA FIRM DIAGRAM
22 12 15 00
PILOTS ANN VERTICAL GYRO 3/ATT 3 LIGHT ON
34 16 03 00
ADI
BOTH ADI ATTITUDE IND DISAGREE (± 4°) IN PITCH AND/OR ROLL
34 21 03 00
INST COMPARATOR
ATTITUDE MESSAGE
34 16 04 00
YES BELOW 1500 FT
CHK CAPT RADIO ALT AND GS RAW DATA AGAINST F/O RADIO ALT AND GS RAW DATA FOR DISAGREEMENT
22 12 16 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 12 XB - -

ROUTINE 1

- CYCLE BOTH YAW SAS SW LTS TO OFF THEN ON
- CYCLE EITHER BAT HANDLE TO OFF, THEN CWS OR CMD

ROUTINE 2

- CYCLE EITHER AP BAT HANDLE TO OFF, THEN CWS OR CMD

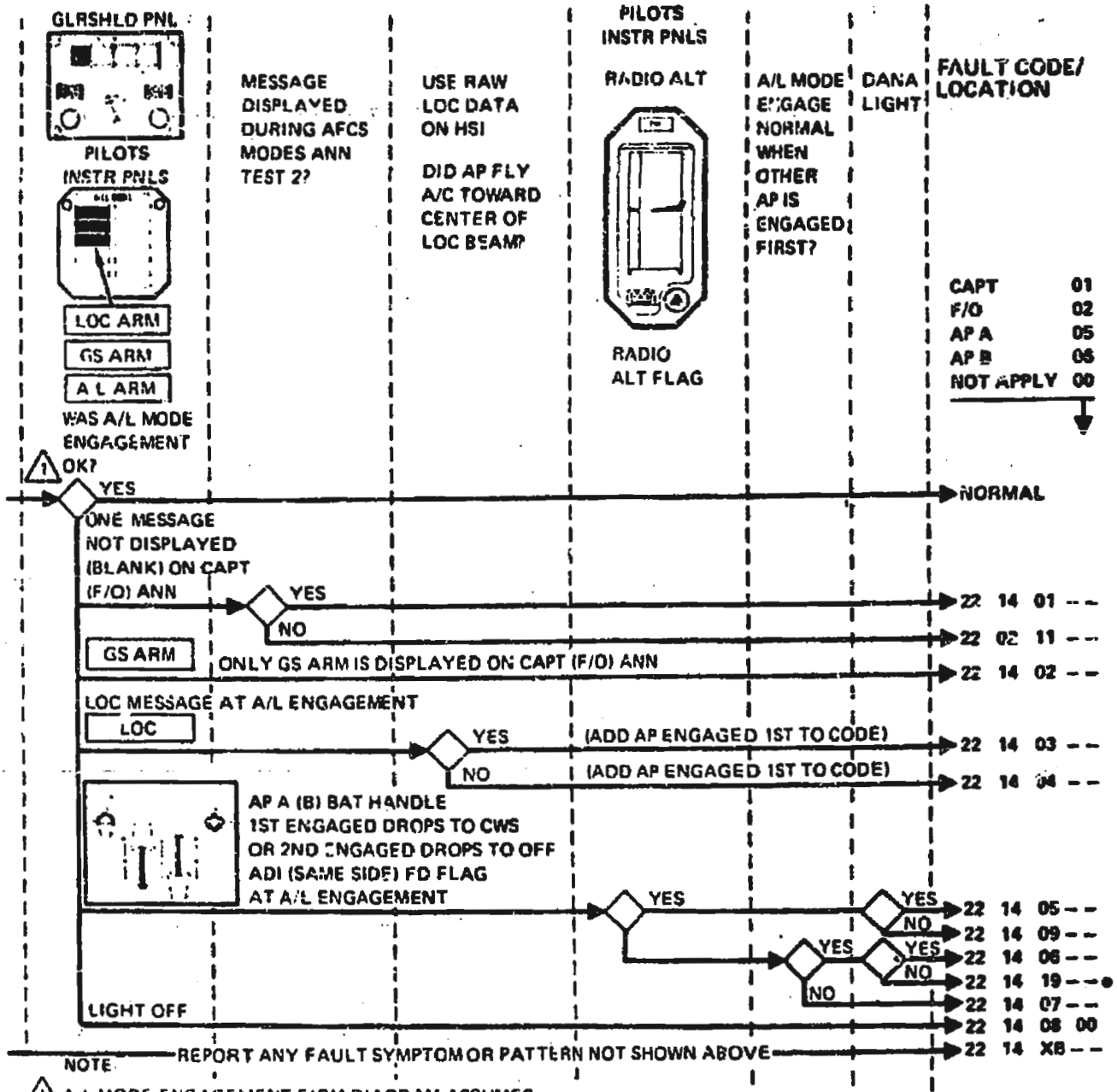
NOTE

(1) OTHER INDICATIONS ARE, FD FLAG IN VIEW ON CAPT (F/O) ADI AND AP BAT HANDLE (SAME SIDE) DROPS TO OFF

(2) NO DANA WHEN OTHER AP IS ENGAGED IN GO AROUND MODE

EDY-0003-22-080

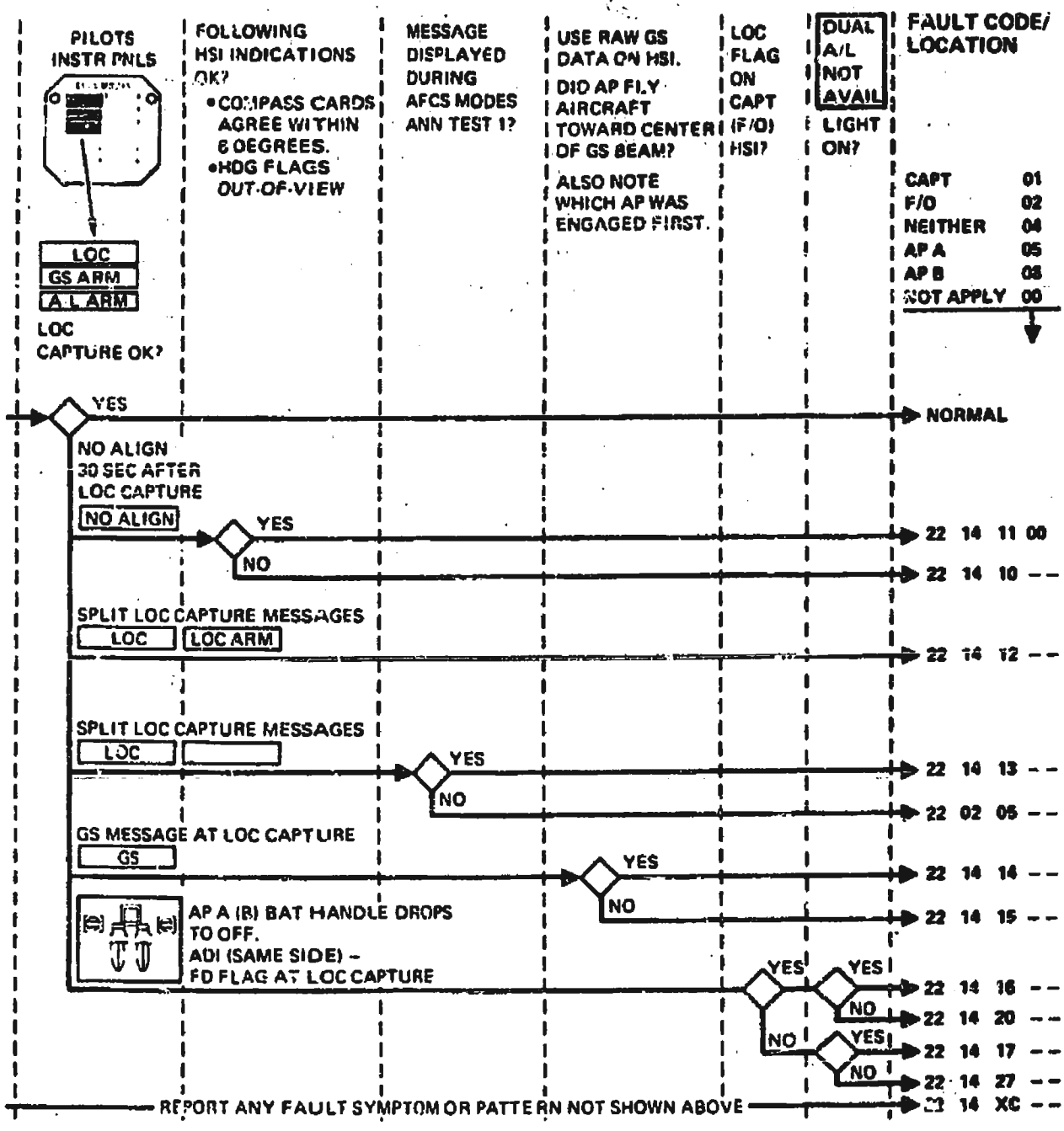
R Soft DANA (Light
R Comes On Upon Altitude, Heading, Speed or Mode Change) - Fault Codes
Figure 27



1. A L MODE ENGAGEMENT FIRM DIAGRAM ASSUMES:
   - CORRECT COURSE SET IN
   - ILS FREQ SET IN
   - BOTH FD ON
   - AP A(B) CMD
   - A L PRESSED
   - OTHER AP TO CMD (REQUIRED FOR DUAL AUTOLAND)

EDI-0003-22-086

R AUTOLAND A/L Mode Engagement - Fault Codes
Figure 28



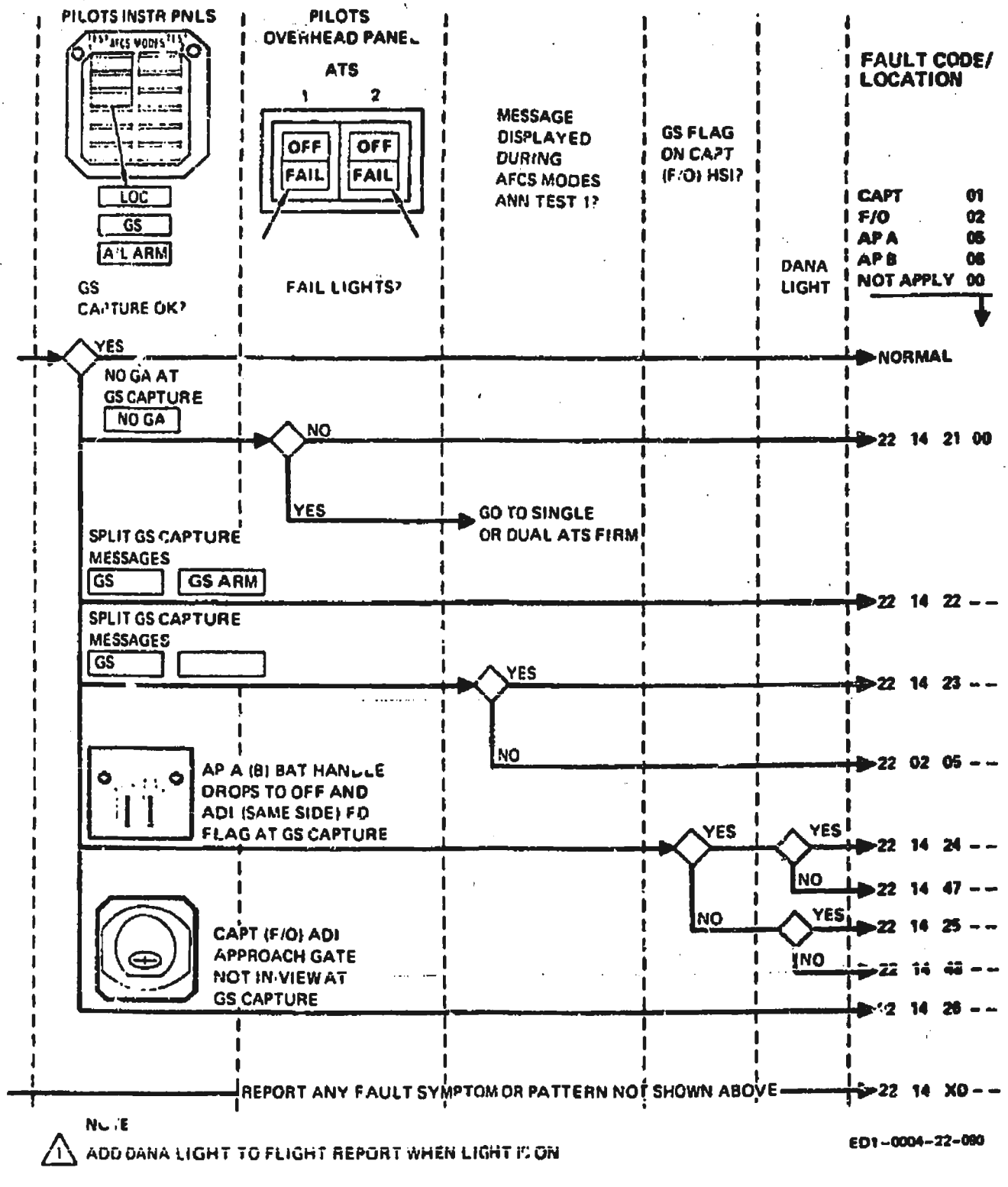
ED1-0003-22-087

R AUTOLAND LOC Capture - Fault Codes
Figure 29

EFFECTIVITY: ALL

0508

22-FAULT CODE DIAGRAM



R AUTOLAND GS Capture - Fault Codes
Figure 30

R EFFECTIVITY: ALL

R 22-FAULT CODE DIAGRAM

R

0508

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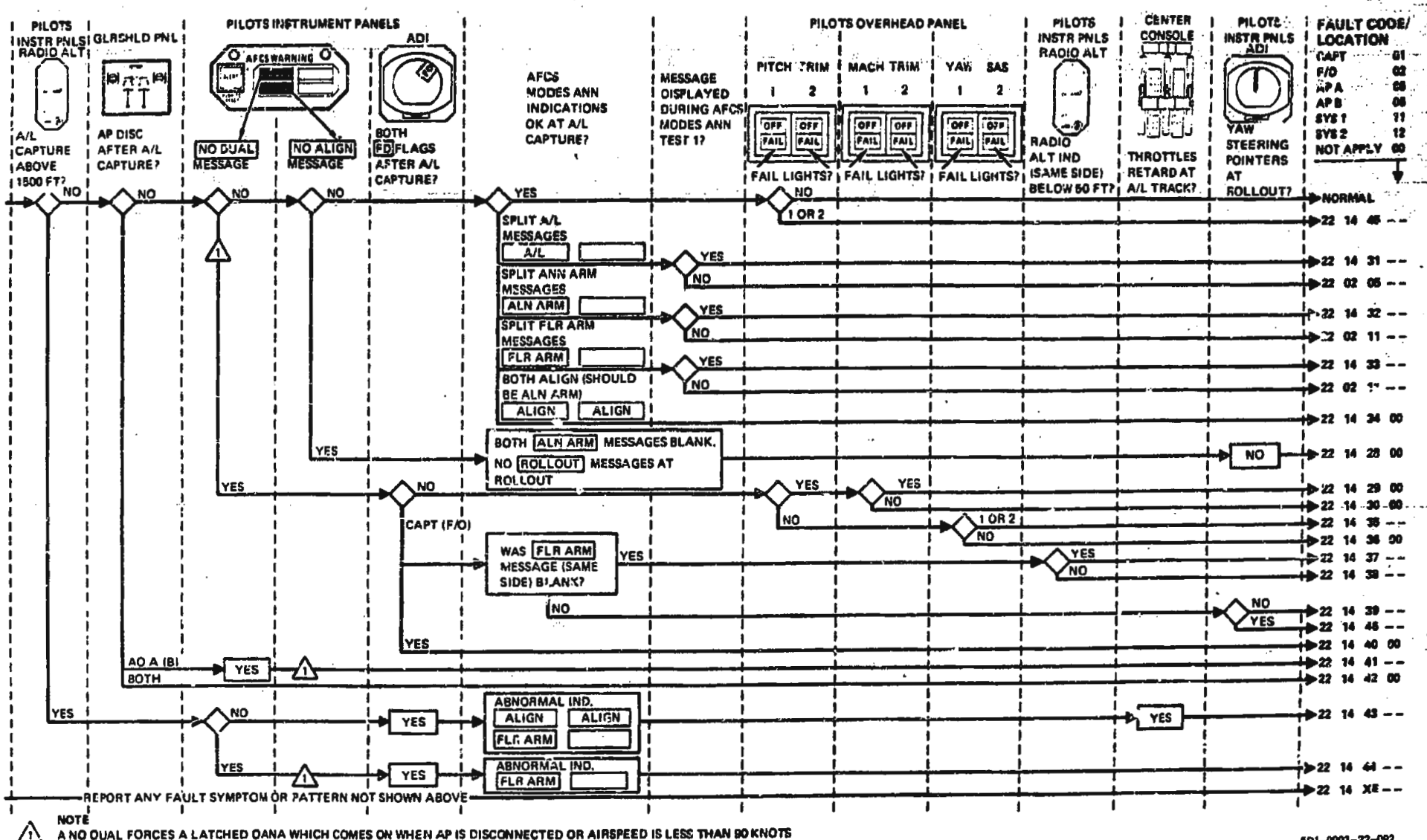

PILOTS INSTR PNLS RADIO ALT
GLRSHLD PNL
PILOTS INSTRUMENT PANELS
ADI
AFCS MODES ANN INDICATIONS OK AT A/L CAPTURE?
MESSAGE DISPLAYED DURING AFCS MODES ANN TEST 1?
PILOTS OVERHEAD PANEL
PITCH TRIM 1 2
MACH TRIM 1 2
YAW SAS 1 2
PILOTS INSTR PNLS RADIO ALT
CENTER CONSOLE
PILOTS INSTR PNLS ADI
FAULT CODE/ LOCATION
CAPT 01
F/O 02
AP A 05
AP B 06
SYS 1 11
SYS 2 12
NOT APPLY 00
A/L CAPTURE ABOVE 1500 FT?
AP DISC AFTER A/L CAPTURE?
NO DUAL MESSAGE
NO ALIGN MESSAGE
BOTH FD FLAGS AFTER A/L CAPTURE?
FAIL LIGHTS?
RADIO ALT IND (SAME SIDE) BELOW 50 FT?
THROTTLES RETARD AT A/L TRACK?
YAW STEERING POINTERS AT ROLLOUT?
NORMAL
SPLIT A/L MESSAGES
SPLIT ANN ARM MESSAGES
SPLIT FLR ARM MESSAGES
BOTH ALIGN (SHOULD BE ALN ARM)
BOTH ALN ARM MESSAGES BLANK.
NO ROLLOUT MESSAGES AT ROLLOUT
CAPT (F/O)
WAS FLR ARM MESSAGE (SAME SIDE) BLANK?
AO A (B) BOTH
ABNORMAL IND.
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE

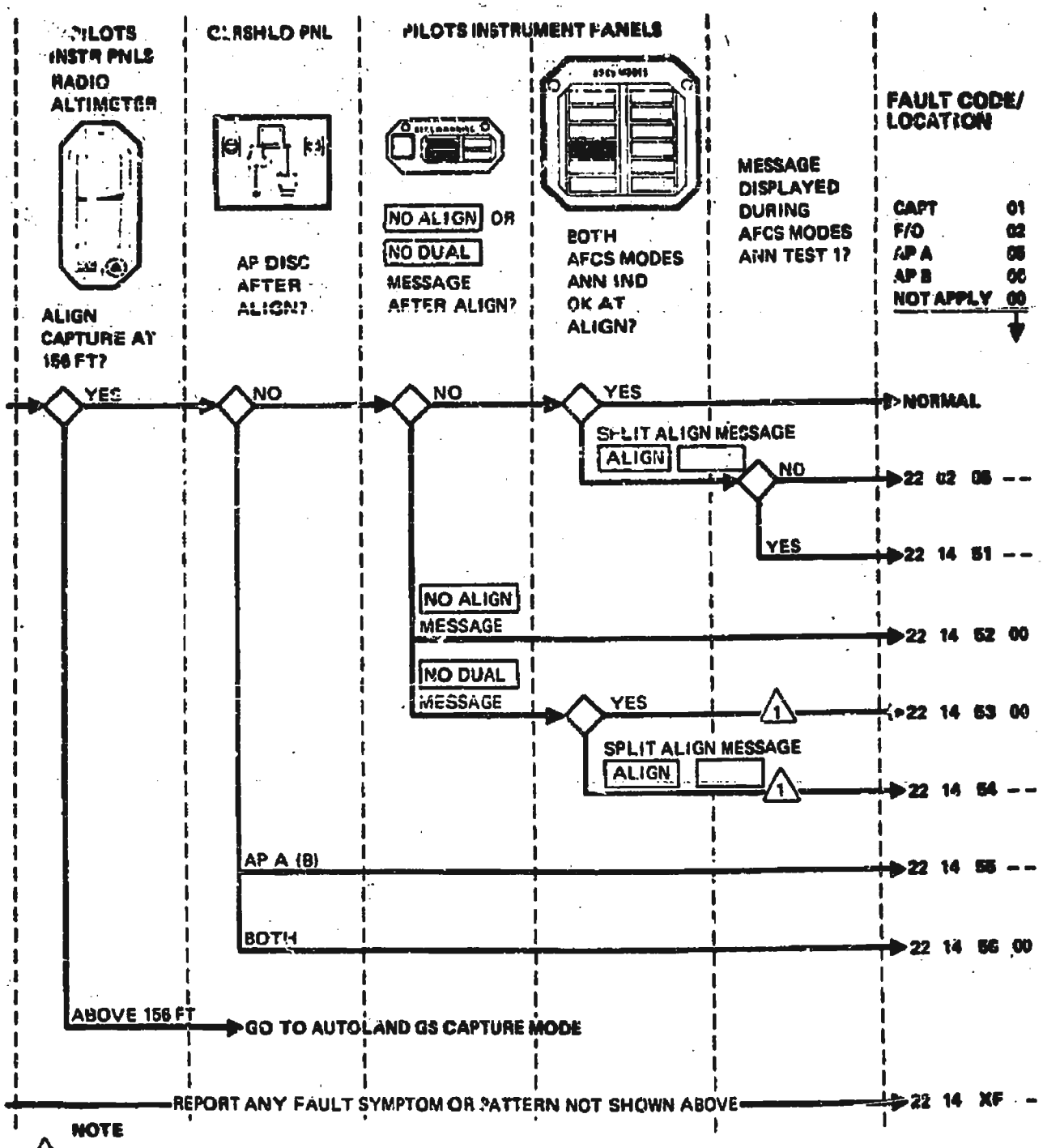
NOTE
1/2 A NO DUAL FORCES A LATCHED DANA WHICH COMES ON WHEN AP IS DISCONNECTED OR AIRSPEED IS LESS THAN 90 KNOTS
A LATCHED DANA CAN ONLY BE RESET BY CYCLING 1A6 AND 1A24CB

ED1-0003-22-092

R AUTOLAND A/L TRACK - Fault Codes
Figure 31

R EFFECTIVITY: ALL
R
0508

22-FAULT CODE DIAGRAM



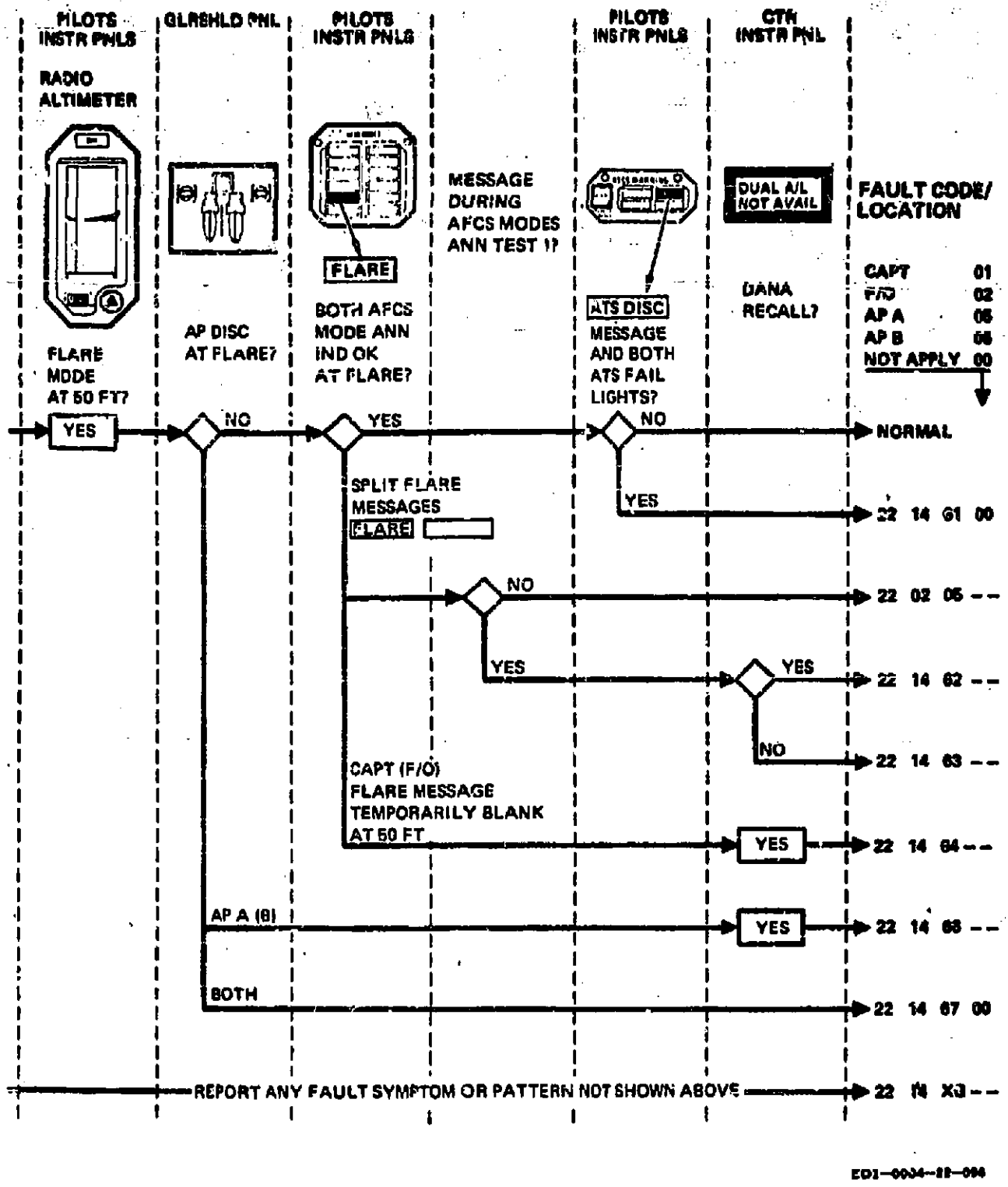
NOTE

1 A NO DUAL FORCES A LATCHED DANA WHICH COMES ON WHEN AP IS DISCONNECTED OR AIRSPEED IS LESS THAN 90 KNOTS.

2 A LATCHED DANA CAN ONLY BE RESET BY CYCLING CB 1A6 AND CB 1A24

ED1-0003-22-084

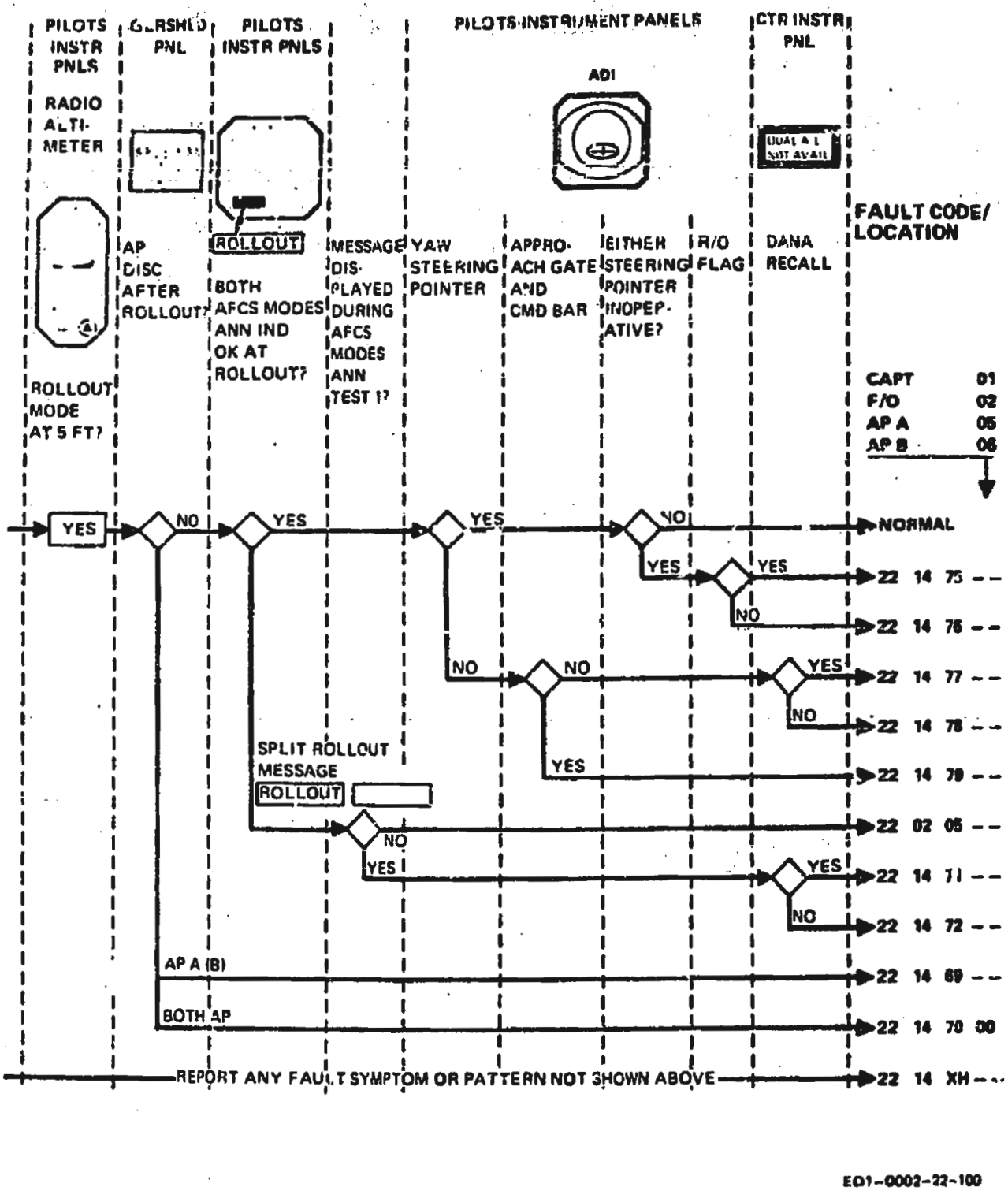
R AUTOLAND ALIGN Mode - Fault Codes
Figure 32



R AUTOLAND FLARE Mode - Fault Codes
Figure 33

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM

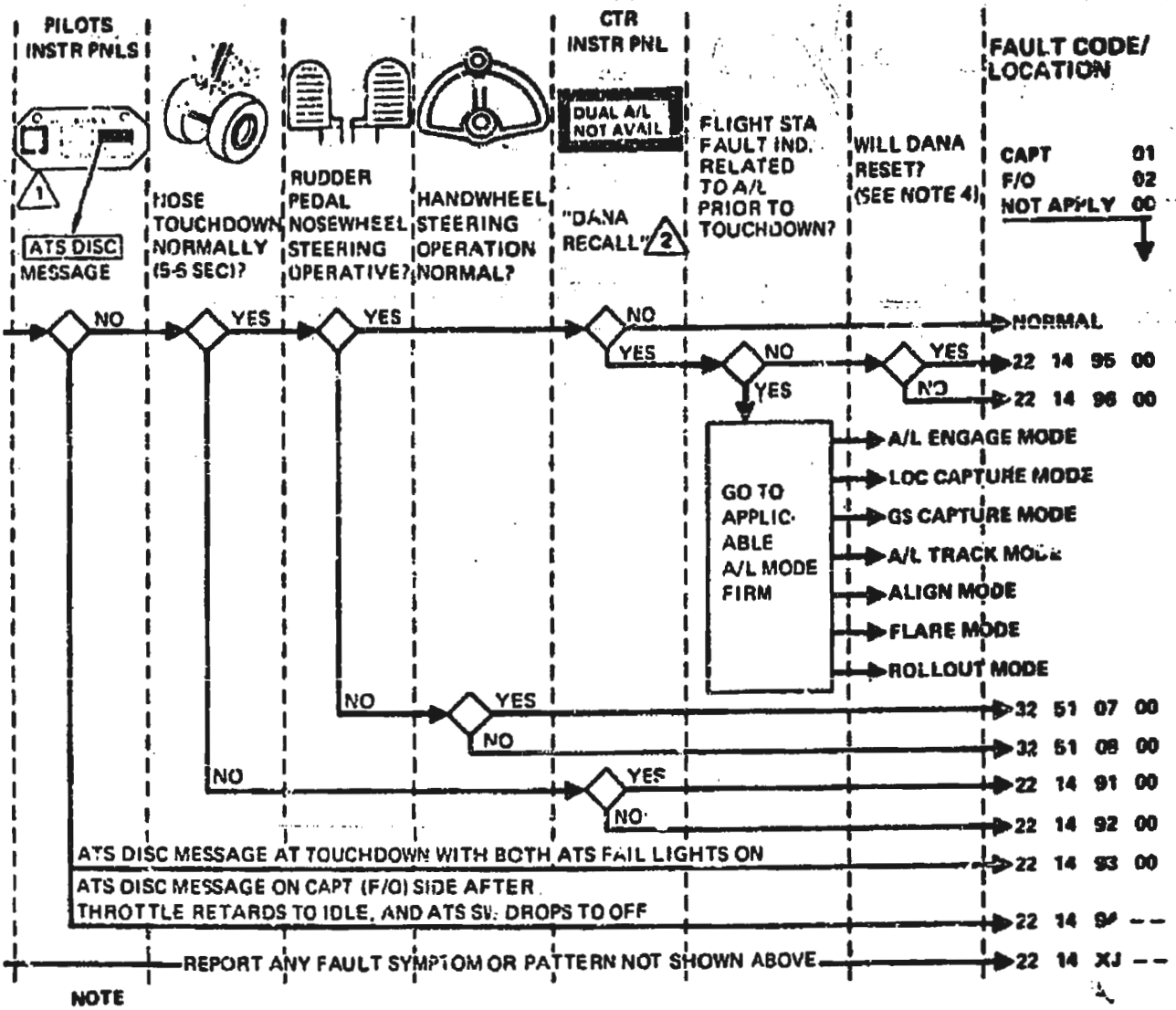


EQ1-0002-22-100

R AUTOLAND ROLLOUT Mode - Fault Codes
Figure 34

EFFECTIVITY: ALL

0508


PILOTS INSTR PNLS
CTR INSTR PNL
FAULT CODE/ LOCATION
DUAL A/L NOT AVAIL
FLIGHT STA FAULT IND. RELATED TO A/L PRIOR TO TOUCHDOWN?
WILL DANA RESET? (SEE NOTE 4)
CAPT 01
F/O 02
NOT APPLY 00
1
ATS DISC MESSAGE
HOSE TOUCHDOWN NORMALLY (5-6 SEC)?
RUDDER PEDAL NOSEWHEEL STEERING OPERATIVE?
HANDWHEEL STEERING OPERATION NORMAL?
"DANA RECALL" 2
NO
YES
NORMAL
22 14 95 00
22 14 96 00
GO TO APPLICABLE A/L MODE FIRM
A/L ENGAGE MODE
LOC CAPTURE MODE
GS CAPTURE MODE
A/L TRACK MODE
ALIGN MODE
FLARE MODE
ROLLOUT MODE
32 51 07 00
32 51 08 00
22 14 91 00
22 14 92 00
ATS DISC MESSAGE AT TOUCHDOWN WITH BOTH ATS FAIL LIGHTS ON
22 14 93 00
ATS DISC MESSAGE ON CAPT (F/O) SIDE AFTER THROTTLE RETARDS TO IDLE, AND ATS SW. DROPS TO OFF
22 14 94 --
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 14 XJ --

NOTE

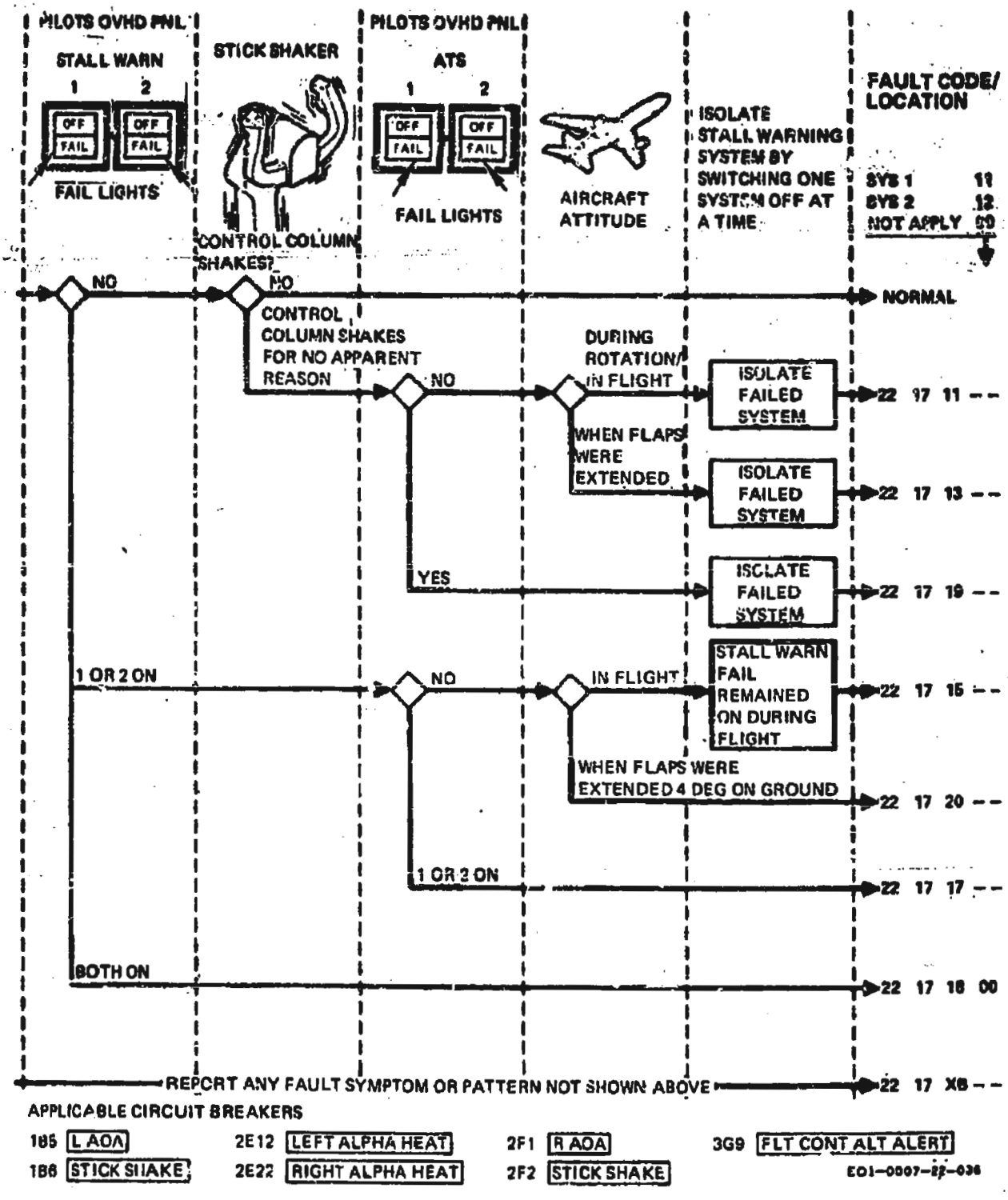
1. THROTTLE LEVERS MOVE FURTHER AFT AND STOP AT IDLE. ATS SWITCH DROPS TO OFF WITHOUT DISCONNECT MESSAGE. THIS WILL OCCUR AT ROLLOUT OR TOUCHDOWN DEPENDING ON SPEED COMPUTER STATUS.
2. "DANA RECALL" IS A DUAL A L NOT AVAIL WARNING THAT IS LATCHED ON AFTER THE AIRCRAFT ARRIVES AT THE RAMP AND THE PILOT DOES NOT REPORT A NO DUAL WARNING. THE DANA LIGHT COMES ON WHEN THE AIRCRAFT SLOWS TO BELOW 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED AFTER AN AUTOLAND.
3. "LATCHED DANA" COMES ON THE SAME AS DANA RECALL BUT IS FORCED ON BY A NO DUAL INDICATION.
4. A DANA THAT IS RECALLED AFTER A AUTOLAND CANNOT BE CLEARED EXCEPT BY REMOVING POWER FROM THE ROLL COMPUTER THAT MEMORIZED THE DANA. A LATCHED DANA CAN ONLY BE RESET BY RECYCLING 1A6 AND 1A24 CB OR WHEN AIRCRAFT POWER IS REMOVED.

ED1-0007-22-101

R AUTOLAND TOUCHDOWN to RAMP - Fault Codes
Figure 35

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM



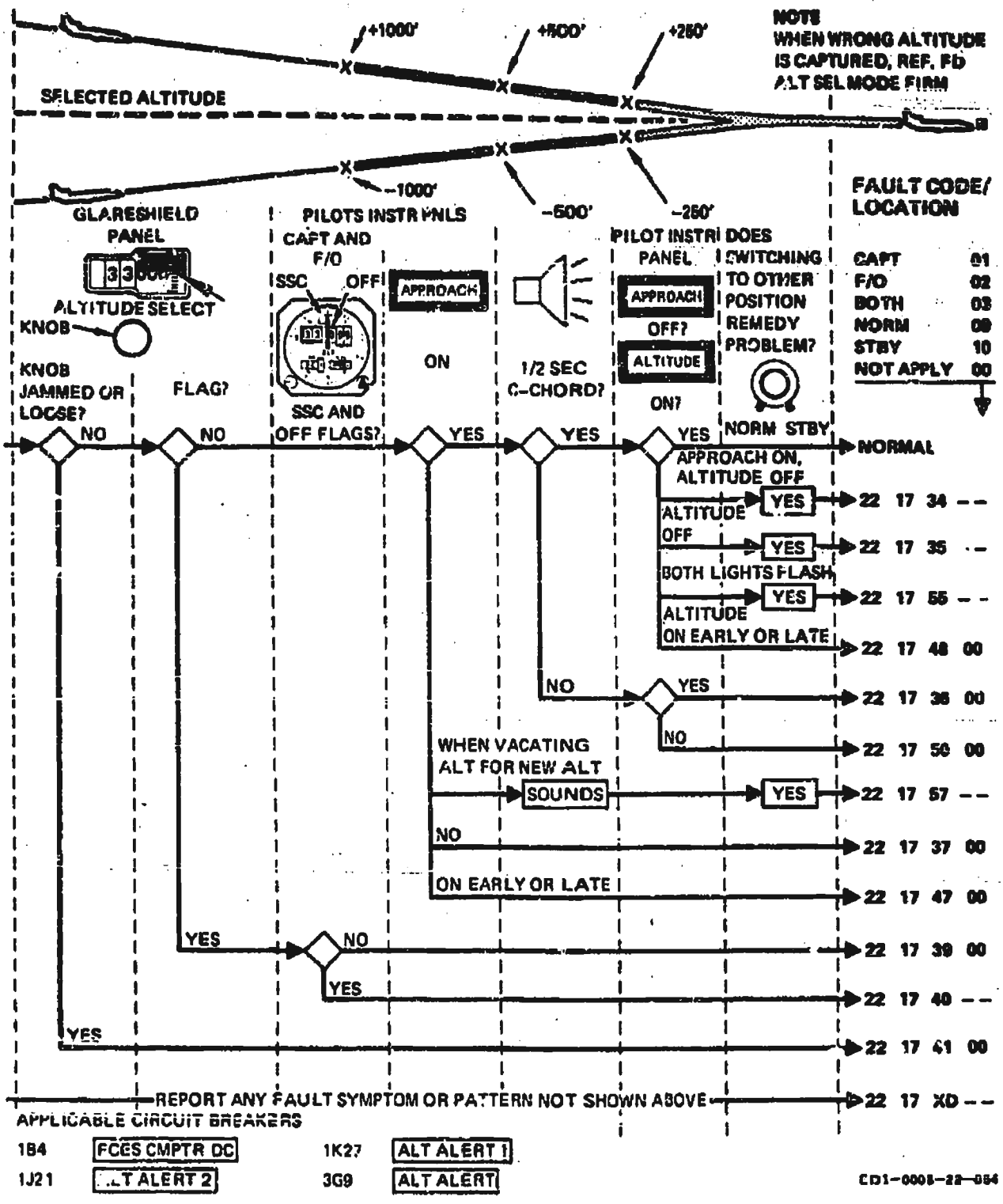
R

Stall Warn - Fault Codes
Figure 36

EFFECTIVITY: ALL

0508

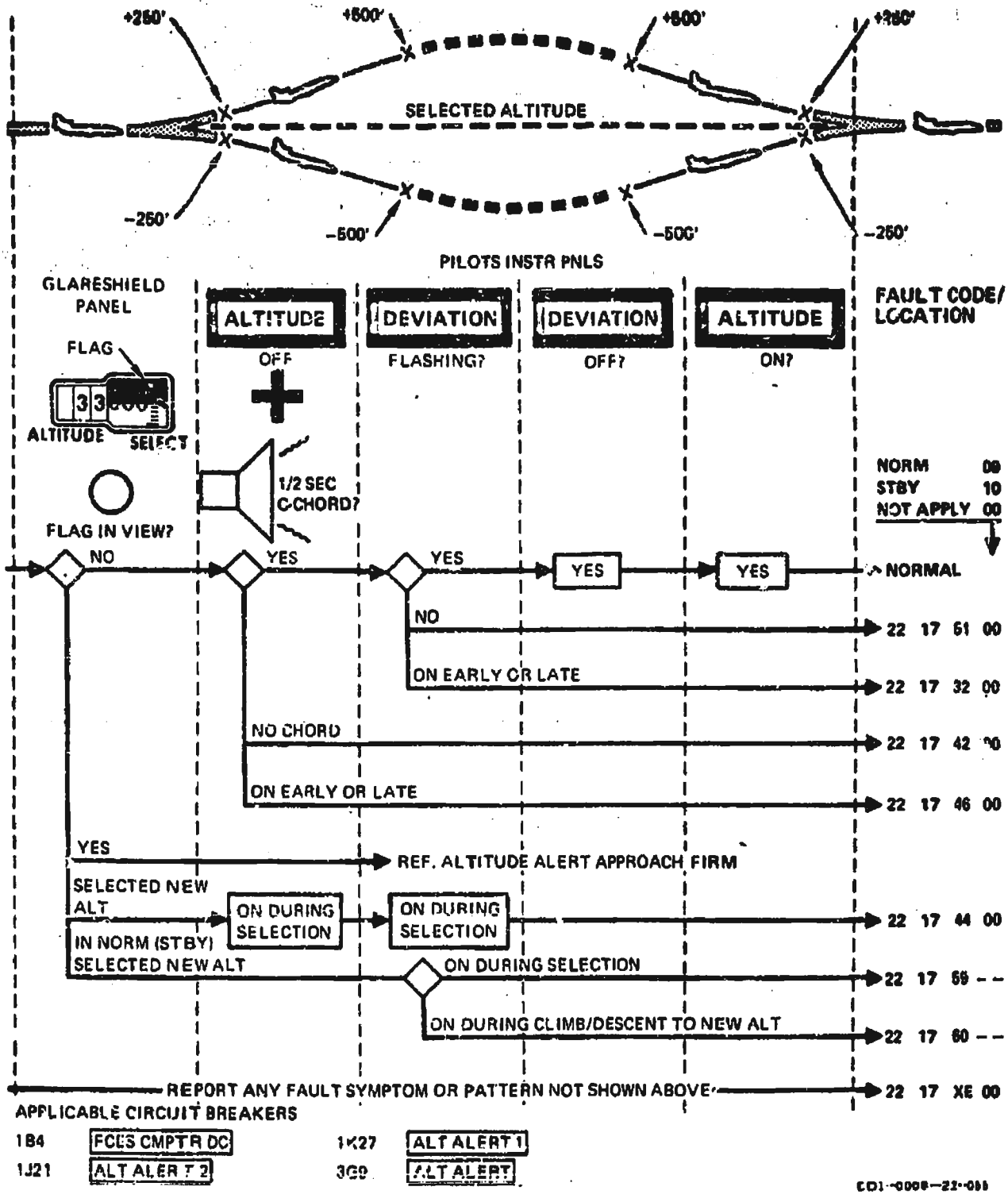
22-FAULT CODE DIAGRAM



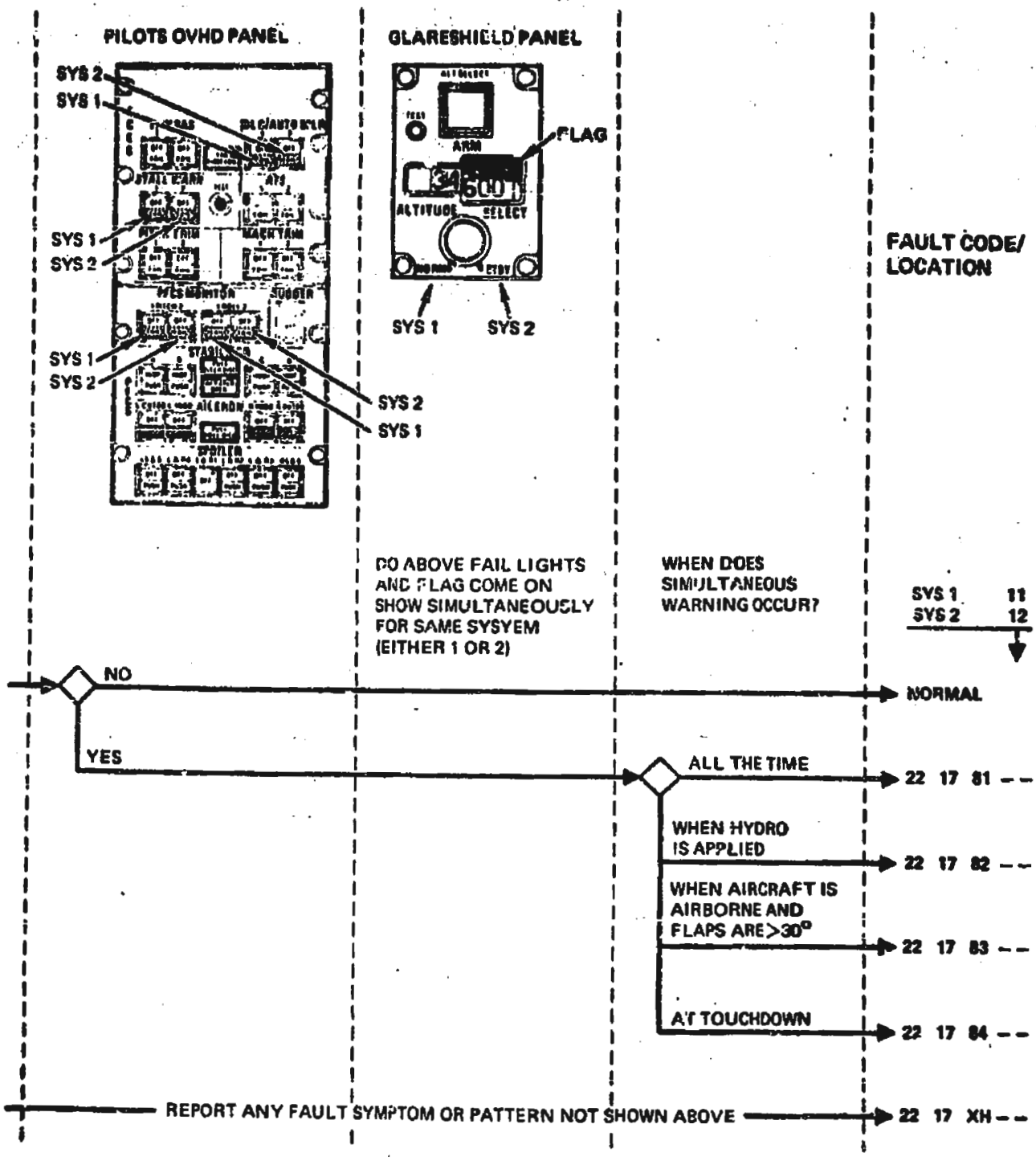
R Altitude Alert Approach - Fault Codes
Figure 37

EFFECTIVITY: ALL

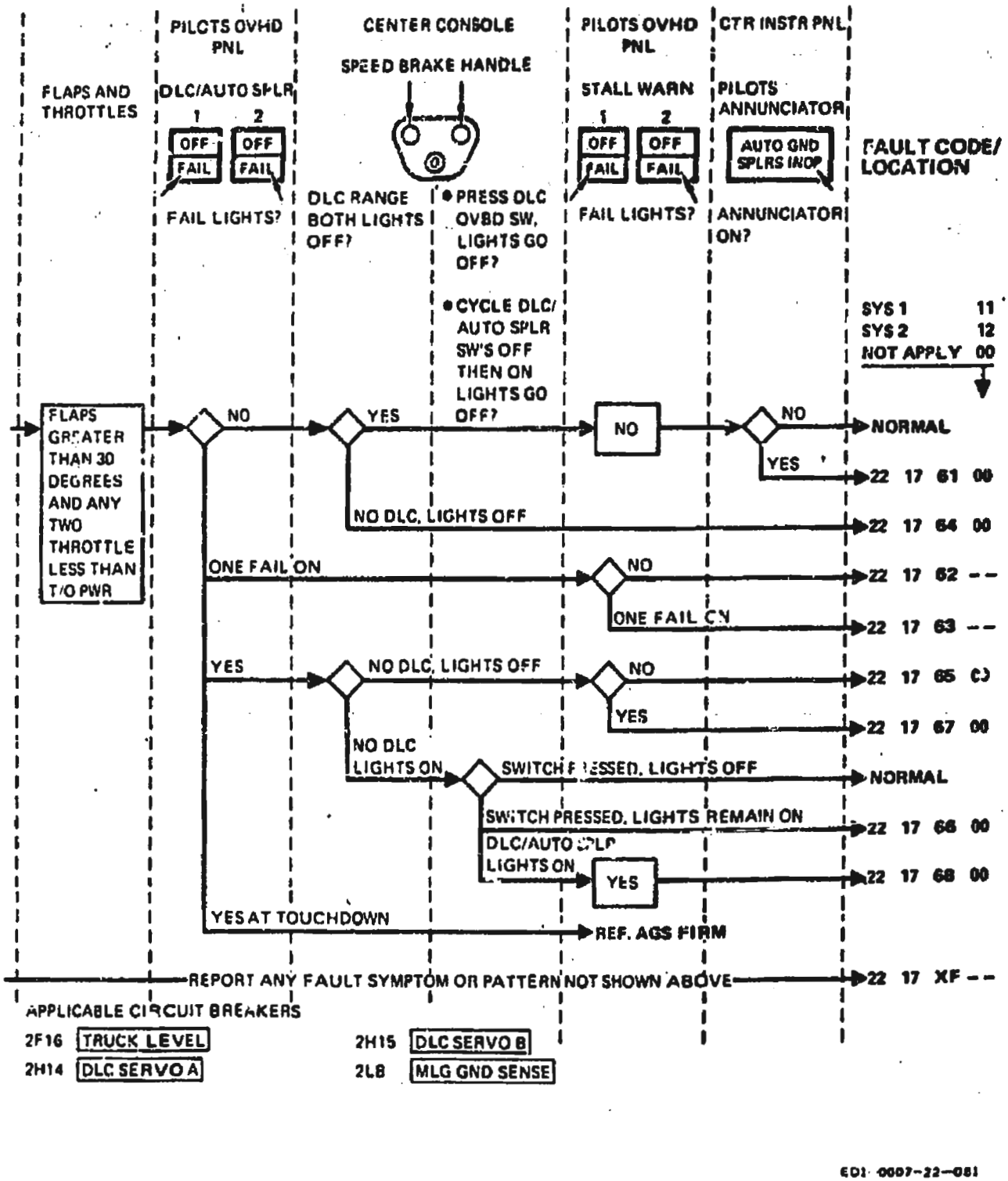
22-FAULT CODE DIAGRAM



R Altitude Alert Deviation - Fault Codes
Figure 38



R Simultaneous Failure of
R PFCS Monitor, DLC/AGS SPLR STALL WARN and ALT SELECT. - Fault Codes
Figure 39



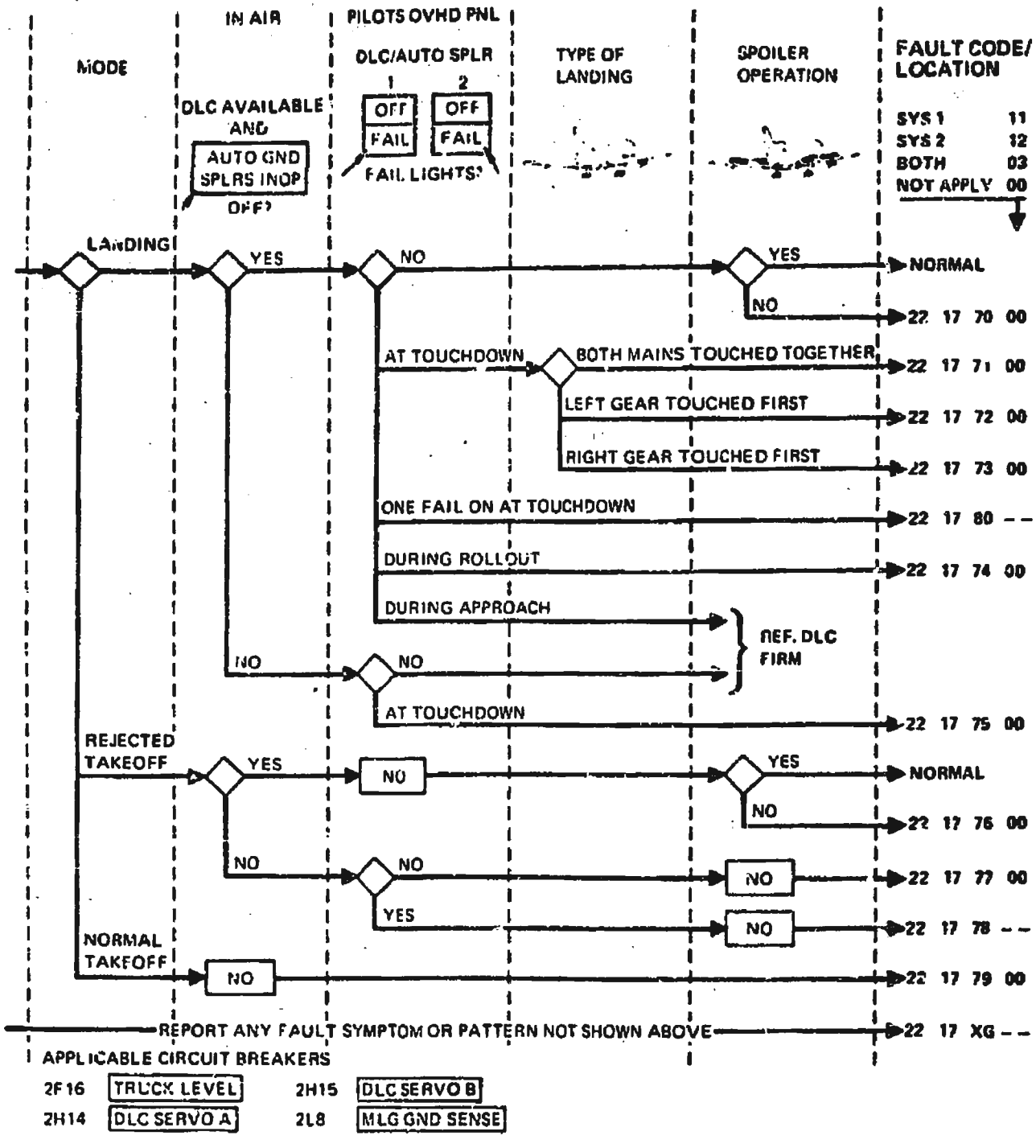
EDI 0007-22-081

R

DLC - Fault Codes
Figure 40

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM



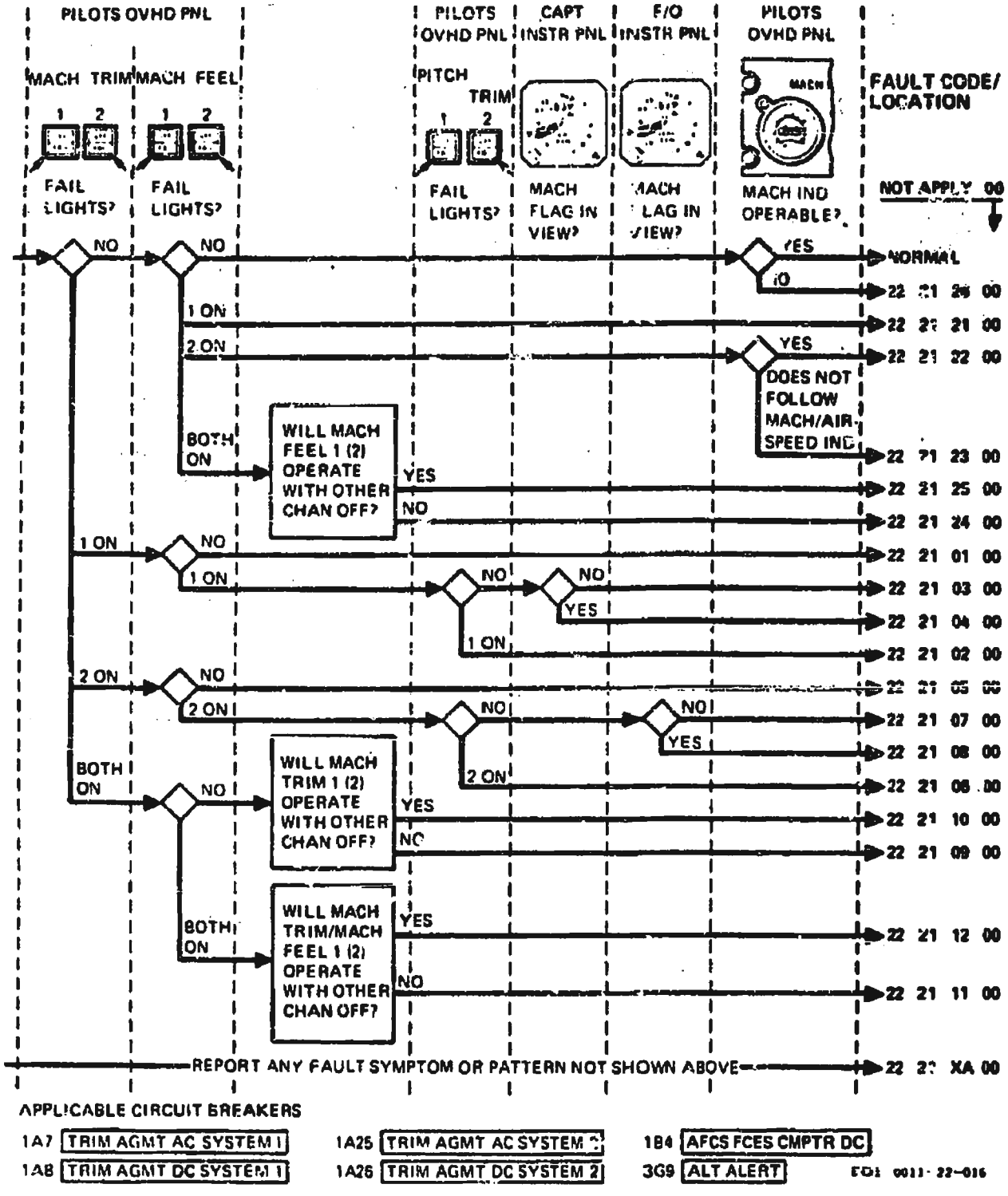
AGSB - Fault Codes
Figure 41

R

EFFECTIVITY: ALL

0508

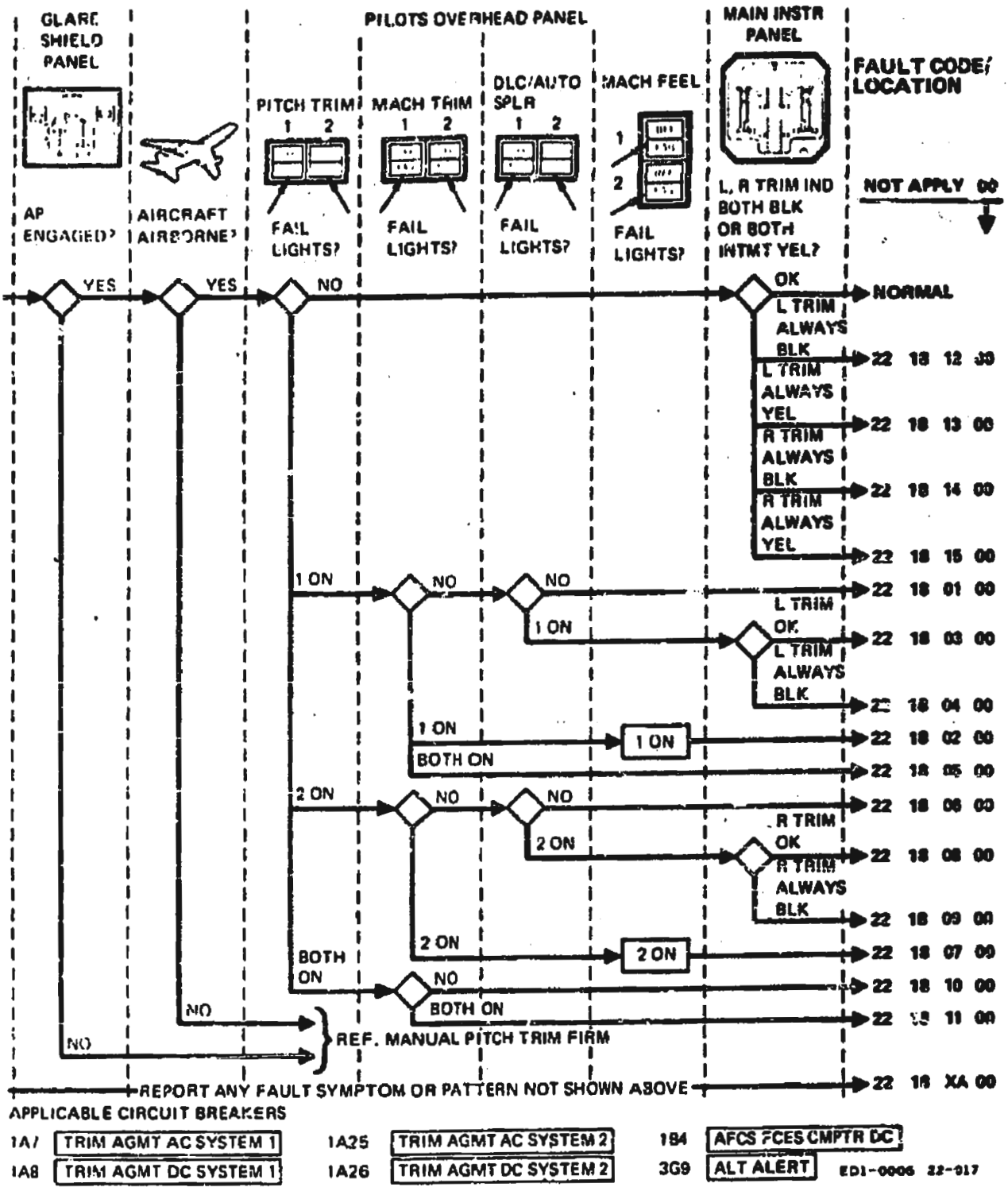
22-FAULT CODE DIAGRAM



R Mach Trim and Feel - Fault Codes
Figure 42

EFFECTIVITY: ALL

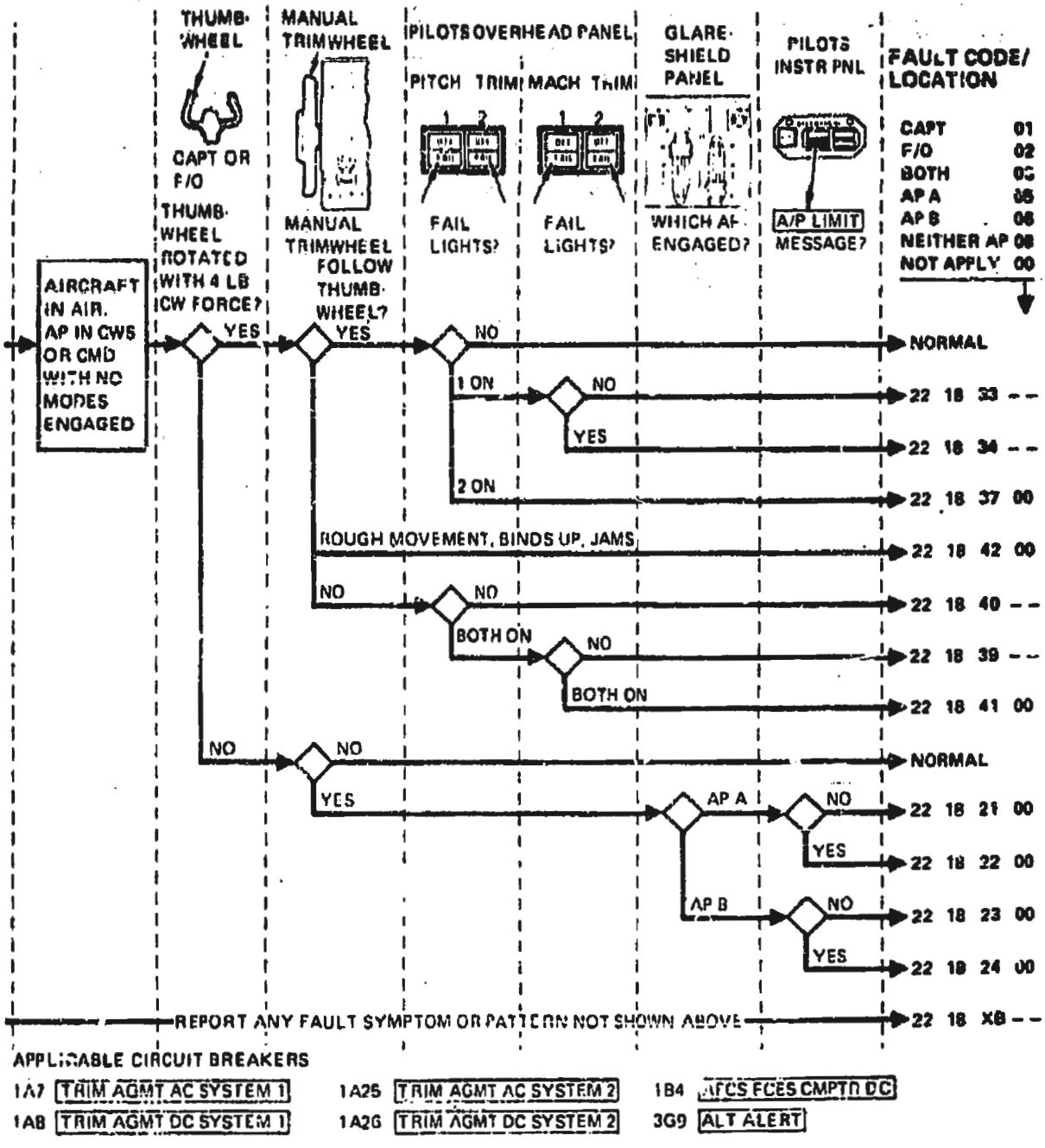
22-FAULT CODE DIAGRAM



R Automatic Pitch Trim - Fault Codes
Figure 43

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM

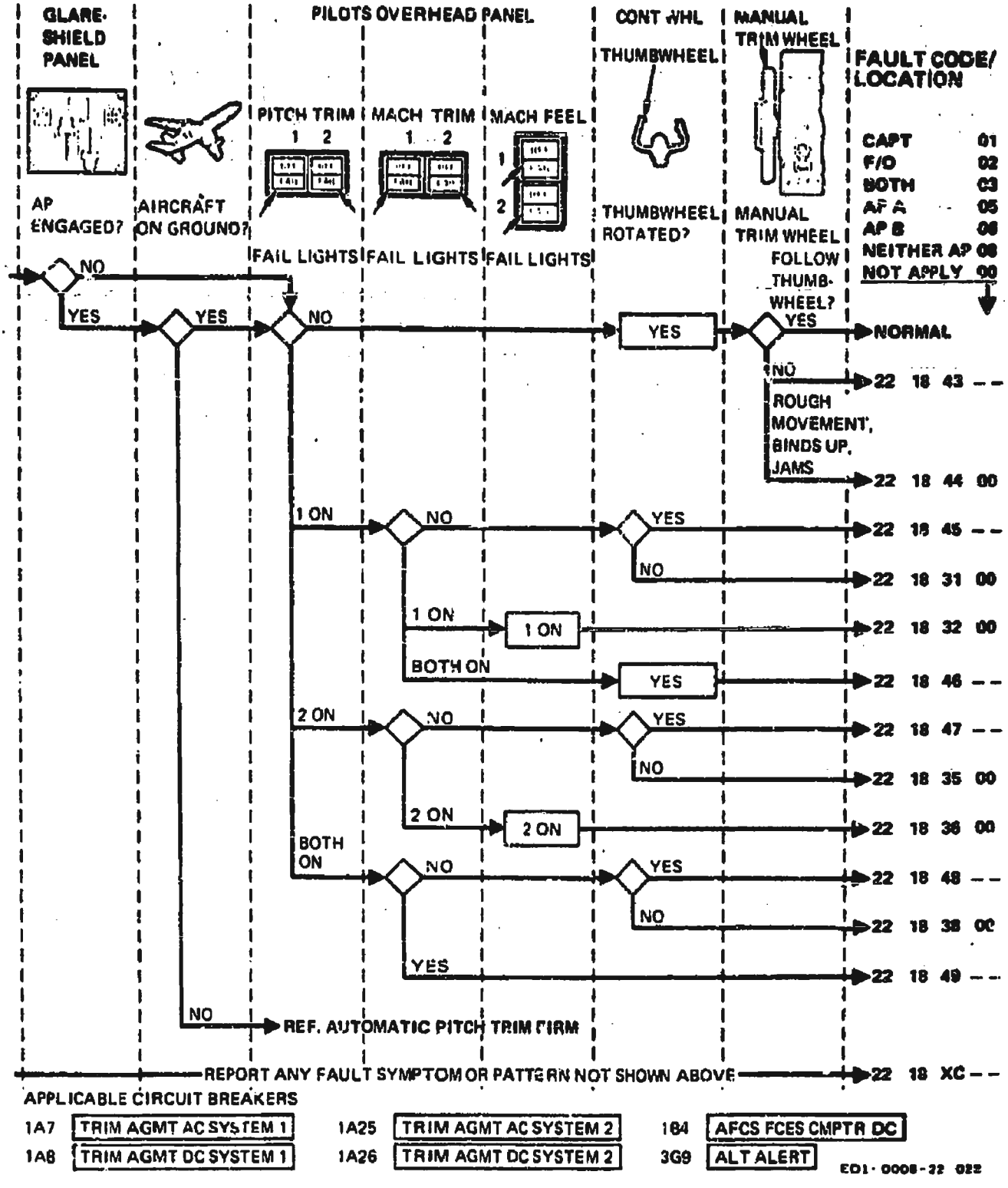


R Manual Ovrd of Auto Pitch Trim (Thumbwheel) - Fault Codes
Figure 44

EFFECTIVITY: ALL

050B

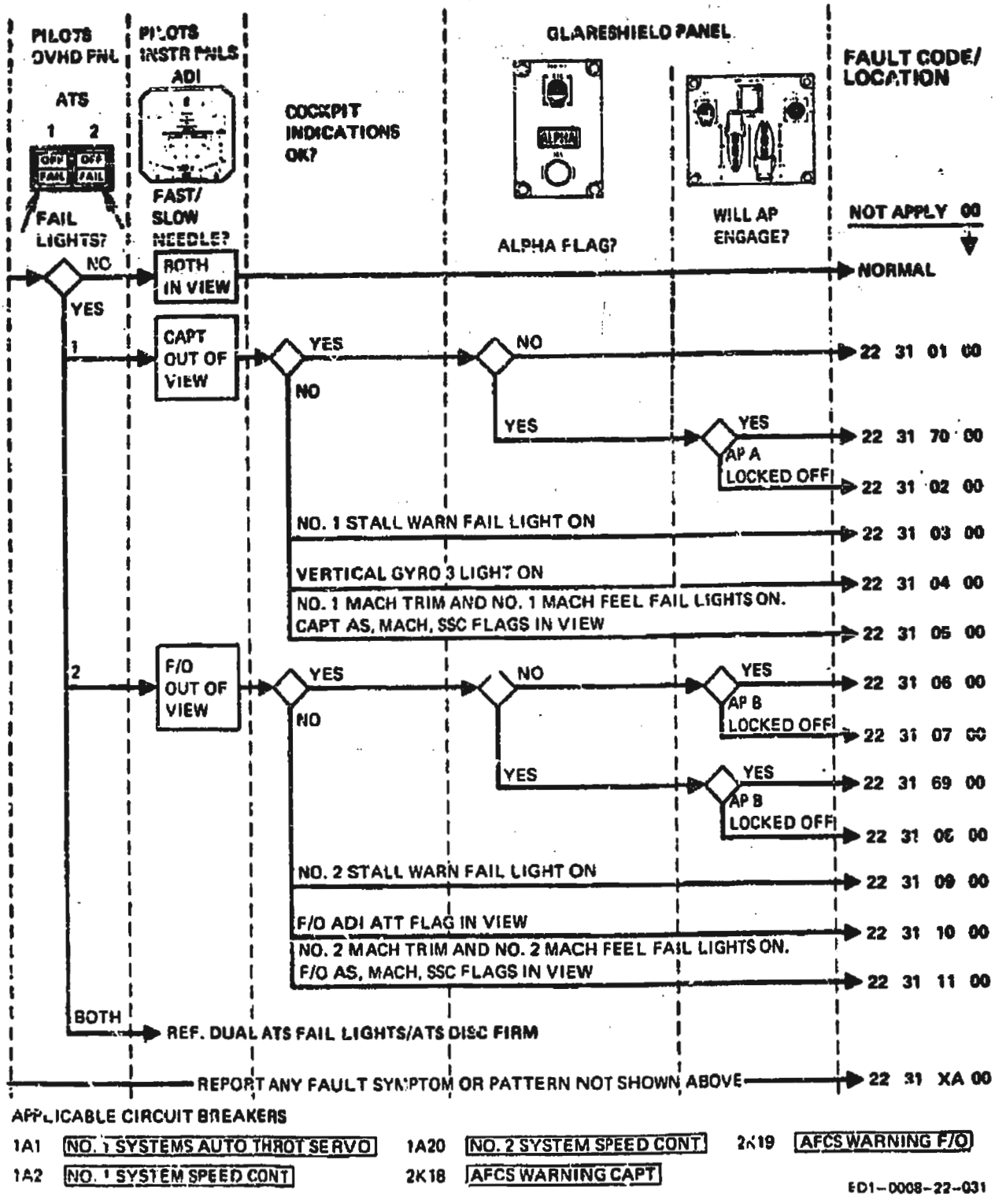
22-FAULT CODE DIAGRAM



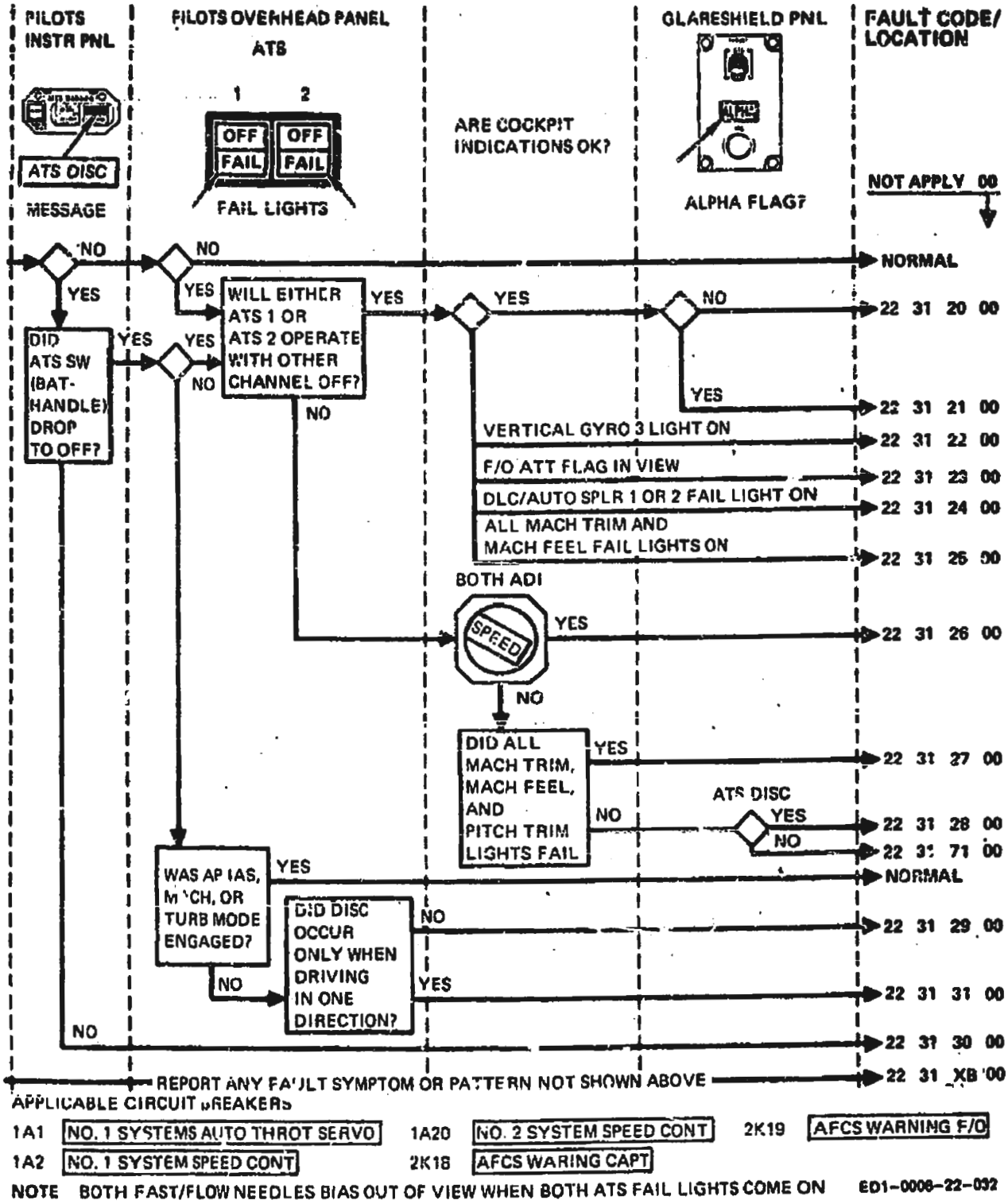
R Manual Pitch Trim (Thumbwheel) - Fault Codes
Figure 45

EFFECTIVITY: ALL

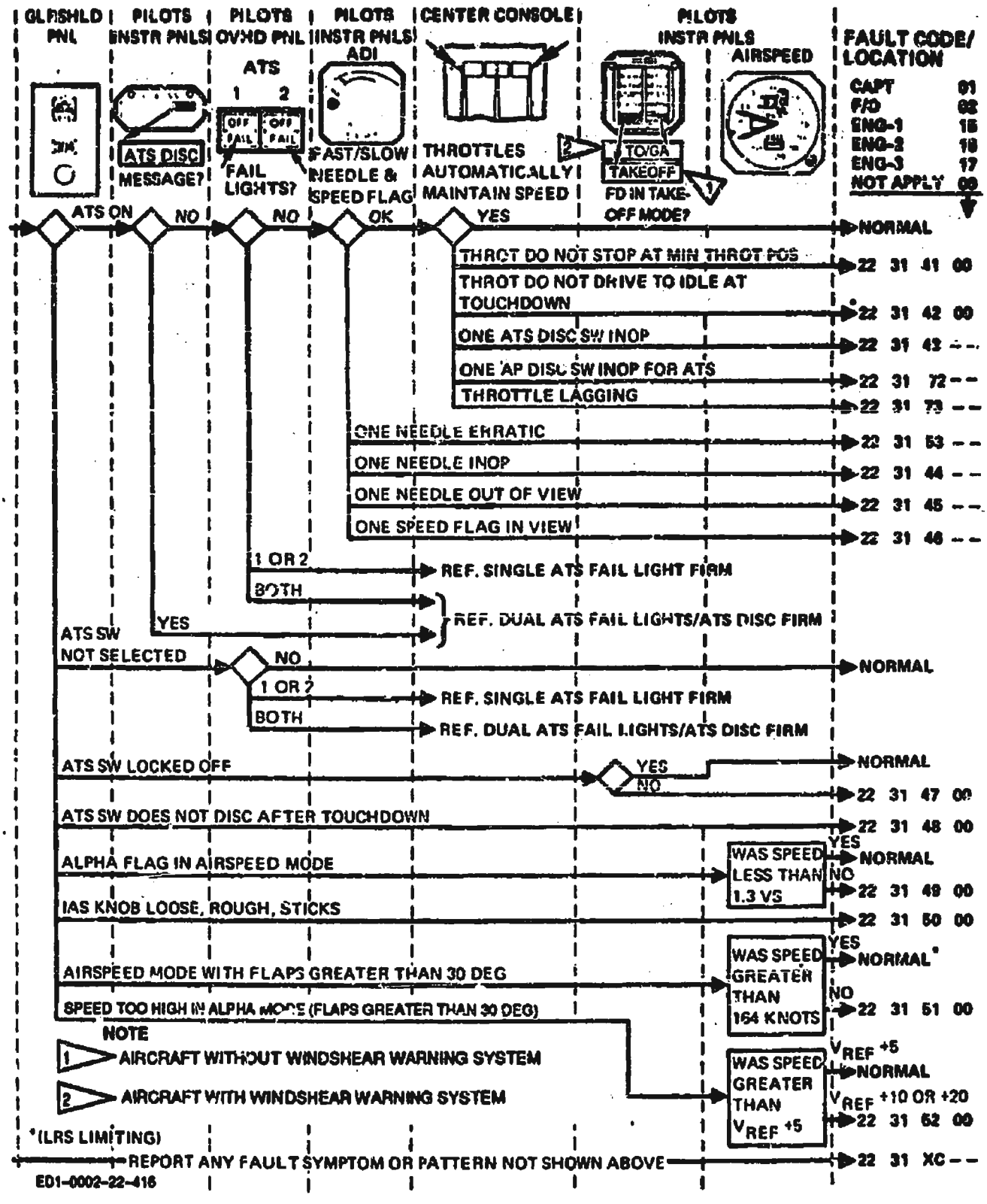
22-FAULT CODE DIAGRAM



Single ATS FAIL Light - Fault Codes
Figure 46


PILOTS INSTR PNL
PILOTS OVERHEAD PANEL
ATS
1
2
OFF
FAIL
OFF
FAIL
GLARESHIELD PNL
FAULT CODE/ LOCATION
ATS DISC
MESSAGE
FAIL LIGHTS
ARE COCKPIT INDICATIONS OK?
ALPHA FLAG?
NOT APPLY 00
NO
YES
NORMAL
DID ATS SW (BAT-HANDLE) DROP TO OFF?
WILL EITHER ATS 1 OR ATS 2 OPERATE WITH OTHER CHANNEL OFF?
22 31 20 00
22 31 21 00
VERTICAL GYRO 3 LIGHT ON
22 31 22 00
F/O ATT FLAG IN VIEW
22 31 23 00
DLC/AUTO SPLR 1 OR 2 FAIL LIGHT ON
22 31 24 00
ALL MACH TRIM AND MACH FEEL FAIL LIGHTS ON
22 31 25 00
BOTH ADI
SPEED
22 31 26 00
DID ALL MACH TRIM, MACH FEEL, AND PITCH TRIM LIGHTS FAIL
22 31 27 00
ATS DISC
22 31 28 00
22 31 71 00
WAS AP IAS, MACH, OR TURB MODE ENGAGED?
DID DISC OCCUR ONLY WHEN DRIVING IN ONE DIRECTION?
22 31 29 00
22 31 31 00
22 31 30 00
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
22 31 XB 00
APPLICABLE CIRCUIT BREAKERS
1A1 NO. 1 SYSTEMS AUTO THROT SERVO
1A2 NO. 1 SYSTEM SPEED CONT
1A20 NO. 2 SYSTEM SPEED CONT
2K18 AFCS WARING CAPT
2K19 AFCS WARNING F/O
NOTE BOTH FAST/FLOW NEEDLES BIAS OUT OF VIEW WHEN BOTH ATS FAIL LIGHTS COME ON
ED1-0006-22-032

R Dual ATS FAIL Lights/ATS DISC - Fault Codes
Figure 47



R Autothrottle/Speed System - Fault Codes
Figure 48

EFFECTIVITY: ALL

22-FAULT CODE DIAGRAM

FAULT CODE INDEX
TABLE 1

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R	22 02 XA __	1. An AFCS MODES Annunciator Test fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 22-02-01 Fig. 103 Block 1
	22 02 XB __	1. An AFCS WARNING Indicator Test fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-02-01 Fig. 104 (Sheet 1) Block 21
R	22 10 XA __	1. An Autopilot Locked-off fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 22-10-33 Fig. 104 (Sheet 1) Block 1
R	22 10 XB __	1. An Autopilot Will Not Remain Engaged fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 22-10-33 Fig. 106 (Sheet 1) Block 11
	22 10 XC __	1. An Autopilot CWS Cruise Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-10-33 Fig. 108 (Sheet 1) Block 21
	22 10 XD __	1. An Autopilot CRUISE Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-10-33 Fig. 108 (Sheet 1) Block 21

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 XE __	1. A Flight Director Basic Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 22-10-31 Fig. 105 (Sheet 1) Block 11
22 10 XF __	1. An Aircraft Porpoising with AP - Turned-on fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 22-10-33 Fig. 109 (Sheet 2) Block 41
22 10 XG __	1. A Control Column Buzz with Autopilot Turned-on fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 22-10-33 Fig. 110 Block 47
22 11 XA __	1. An Autopilot VS Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 22-11-31 Fig. 104 (Sheet 3) Block 11
22 11 XB __	1. An Autopilot ALTITUDE SELECT/HOLD Mode fault was encountered by the crew which is not covered in the fault code diagram (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-33 Fig. 104 (Sheet 1) Block 1 22-11-35 Fig. 104 (Sheet 1) Block 1
22 11 XC __	1. An Autopilot IAS Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-37 Fig. 104 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 XD __	1. An Autopilot MACH Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-39 Fig. 104 (Sheet 1) Block 1
22 11 XF __	1. A Flight Director VS Hold Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-31 Fig. 104 (Sheet 1) Block 1
22 11 XG __	1. A Flight Director Altitude Hold Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-33 Fig. 104 (Sheet 1) Block 1
22 11 XH __	1. A Flight Director Altitude Select (ALT ARM) Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-35 Fig. 104 (Sheet 1) Block 1
22 11 XJ __	1. A Flight Director MACH Hold Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-39 Fig. 104 (Sheet 1) Block 1
22 11 XK __	1. An Autopilot Turbulence Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-11-43 Fig. 103 (Sheet 1) Block 1 22-11-43 Fig. 104 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 XQ __	1. A Flight Director IAS Hold Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-11-37 Fig. 104 (Sheet 1) Block 1
22 12 XA __	1. An Hard DANA (Light Comes On Immediately After AP Is Engaged or During Straight and Level Flight) fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-12-37 Fig. 104 (Sheet 1) Block 1
22 12 XB __	1. A Soft DANA (Light Comes On Upon Altitude, Heading, Speed or Mode Change) fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-12-37 Fig. 105 (Sheet 1) Block 11
22 13 XA __	1. A Flight Director Heading Select Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-13-31 Fig. 104 (Sheet 1) Block 1
22 13 XB __	1. An Autopilot HDG SEL Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-13-31 Fig. 104 (Sheet 1) Block 1
22 14 XA 00	1. An AUTOLAND Overview fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-14-31 Fig. 103 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 XB __	1. An AUTOLAND A/L Mode Engagement fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 104 (Sheet 1) Block 1
22 14 XC __	1. An AUTOLAND LOC Capture fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 105 (Sheet 1) Block 11
22 14 XD __	1. An AUTOLAND GS Capture fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 106 (Sheet 1) Block 21
22 14 XE __	1. An AUTOLAND A/L TRACK fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 107 (Sheet 1) Block 31
22 14 XF __	1. An AUTOLAND ALIGN Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 108 (Sheet 1) Block 51
22 14 XG __	1. An AUTOLAND FLARE Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 109 (Sheet 1) Block 61

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 XH __	1. An AUTOLAND ROLLOUT Mode fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 110 (Sheet 1) Block 71
22 14 XJ __	1. An AUTOLAND TOUCHDOWN to RAMP fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-14-31 Fig. 111 (Sheet 1) Block 91
22 15 XA 00	1. A YAW SAS FAIL Light fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-15-00 Fig. 104 (Sheet 1) Block 1
22 17 XA __	1. A Stall Warn Test fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-17-05 Fig. 104 (Sheet 1) Block 1
22 17 XB __	1. A Stall Warn fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-17-05 Fig. 105 (Sheet 1) Block 10
22 17 XC 00	1. An Altitude Alert Test fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 22-17-05 Fig. 104 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	22 17 XD __	1. An Altitude Alert Approach fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-17-06 Fig. 104 (Sheet 1) Block 1
R	22 17 XE OC	1. An Altitude Alert Deviation fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 22-17-06 Fig. 105 (Sheet 1) Block 15
	22 17 XF __	1. A DLC fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-17-07 Fig. 104 (Sheet 1) Block 1
	22 17 XG __	1. An AG3B fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-17-07 Fig. 105 (Sheet 1) Block 10
	22 17 XH __	1. A Simultaneous Failure of PFCS Monitor, DLC/AGS SPLR STALL WARN and ALT SELECT. fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-17-09 Fig. 103 (Sheet 1) Block 1
	22 18 XA 00	1. An Automatic Pitch Trim fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 22-18-00 Fig. 104 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 18 XB __	1. A Manual Ovrd of Auto Pitch Trim (Thumbwheel) fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-18-00 Fig. 106 (Sheet 1) Block 21
22 18 XC __	1. A Manual Pitch Trim (Thumbwheel) fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-18-00 Fig. 106 (Sheet 1) Block 31
22 21 XA 00	1. A Mach Trim and Feel fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-21-00 Fig. 104 (Sheet 1) Block 1 22-21-00 Fig. 105 (Sheet 1) Block 21
22 31 XA 00	1. A Single ATS FAIL Light fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-31-00 Fig. 104 (Sheet 1) Block 1
22 31 XB 00	1. A Dual ATS FAIL Lights/ATS DISC fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-31-00 Fig. 105 (Sheet 1) Block 20
R 22 31 XC __	1. An Autothrottle/Speed System fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 22-31-00 Fig. 106 (Sheet 1) Block 40

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 02 01 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 1, TURB light did not come on. OK during light test.
	2. 22-02-01 Fig. 103 Fault 1
22 02 02 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 1, TURB light did not come on. Remained off during light test.
	2. 22-02-01 Fig. 103 Fault 2
22 02 03 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 1, VS or IAS or HDG light did not come on. OK during light test. (List light not on.)
	2. 22-02-01 Fig. 103 Fault 3
22 02 04 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 1, VS or IAS or HDG light did not come on. Remained off during light test. (List light not on.)
	2. 22-02-01 Fig. 103 Fault 4
22 02 05 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 1, a message was not displayed. (List message not displayed.)
	2. 22-02-01 Fig. 103 Fault 5
22 02 06 __	1. (01=CAPT, 02=F/O) AFCS MODES ann TEST 1 inoperative.
	2. 22-02-01 Fig. 103 Fault 6
22 02 07 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 2, ALT SELECT ARM light did not come on. OK during light test.
	2. 22-02-01 Fig. 103 Fault 7

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R 22 02 08 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 2, ALT SELECT ARM light did not come on. Remained off during light test.
R	2. 22-02-01 Fig. 103 Fault 8
R 22 02 09 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 2, light did not come on. OK during light test. (List light not on.)
R	2. 22-02-01 Fig. 103 Fault 9
R 22 02 10 __	1. During (01=CAPT, 02=F/O) AFCS MODES ann TEST 2, light did not come on. Remained off during light test. (List light not on.)
R	2. 22-02-01 Fig. 103 Fault 10
R 22 02 11 __	1. During (01=CAPT, 02=F/C) AFCS MODES ann TEST 2, a message was not displayed. (List message not displayed.)
R	2. 22-02-01 Fig. 103 Fault 11
R 22 02 12 __	1. (01=CAPT, 02=F/O) AFCS MODES ann TEST 2 inoperative.
R	2. 22-02-01 Fig. 103 Fault 12
22 02 13 00	1. NOT USED.
22 02 14 00	1. NOT USED.
22 02 15 00	1. NOT USED.
22 02 16 00	1. NOT USED.
22 02 17 00	1. NOT USED.
22 02 18 00	1. NOT USED.
22 02 19 00	1. NOT USED.
22 02 20 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 02 21 __	1. During (01=CAPT, 02=F/O) AFCS WARNING indicator TEST 1, ALERT or a message not displayed on other indicator. (Specify message not displayed.)
	2. 22-02-01 Fig. 104 Fault 21
22 02 22 __	1. During (01=CAPT, 02=F/O) AFCS WARNING indicator TEST 1, ALERT or a message not displayed on indicator under test. (Specify message not displayed.)
	2. 22-02-01 Fig. 104 Fault 22
22 02 23 __	1. (01=CAPT, 02=F/O) AFCS WARNING indicator TEST 1 inoperative.
	2. 22-02-01 Fig. 104 Fault 23
22 02 24 __	1. During (01=CAPT, 02=F/O) AFCS WARNING indicator TEST 1, message other than AP LIMIT, NO FLARE was displayed on other indicator. (Specify message displayed.)
	2. 22-02-01 Fig. 104 Fault 23A
22 02 25 __	1. During (01=CAPT, 02=F/O) AFCS WARNING indicator TEST 2, ALERT or a message not displayed on other indicator. (List message not displayed.)
	2. 22-02-01 Fig. 104 Fault 24
22 02 26 __	1. During (01=CAPT, 02=F/O) AFCS WARNING indicator TEST 2, ALERT or a message not displayed on indicator under test. (List message not displayed.)
	2. 22-02-01 Fig. 104 Fault 25
22 02 27 __	1. (01=CAPT, 02=F/O) AFCS WARNING indicator TEST 2 inoperative.
	2. 22-02-01 Fig. 104 Fault 26

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 02 28 __	1. During (01=CAPT, 02-F/O) AFCS WARNING indicator TEST 2, message other than NO DUAL, NO ALIGN, CMD DISC displayed on other indicator. (Specify message displayed.) 2. 22-02-01 Fig. 104 Fault 27
22 10 01 __	1. (05=AP A, 06=AP B) bat handle locked off. No other flt sta indications. 2. 22-10-33 Fig. 104 Fault 1
22 10 02 __	1. (05=AP A, 06=AP B) bat handle locked-off. ATT flag in-view on ADI (same side). FD flag in-view, CMD bar out-of-view on ADI (same side) when FD turned on. 2. 22-10-33 Fig. 104 Fault 2
22 10 03 __	1. (05=AP A, 06=AP B) bat handle locked-off. HDG flag in-view on HSI (same side) and on RDDMI (opposite side). FD flag in-view. ADI (same side) CMD bar out-of-view when FD turned-on. 2. 22-10-33 Fig. 104 Fault 3
22 10 04 __	1. (05=AP A, 06=AP B) bat handle locked-off. FD flag in-view, CMD bar out-of-view on ADI (same side) when FD turned-on. 2. 22-10-33 Fig. 104 Fault 4
22 10 05 __	1. (05=AP A, 06=AP B) bat handle locked-off. ATS FAIL light (same side) came on and ADI (same side) FAST/SLOW needle out-of-view in ALPHA mode. 2. 22-10-33 Fig. 104 Fault 5
22 10 06 __	1. (05=AP A, 06=AP B) bat handle locked off. YAW SAS FAIL light (same side) on. 2. 22-10-33 Fig. 104 Fault 6

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 07 __	1. (05=AP A, 06=AP B) bat handle locked-off. YAW SAS FAIL light (same side) comes on during turn coordination.
	2. 22-10-33 Fig. 104 Fault 7
22 10 08 00	1. Both AP bat handles locked-off in TAKEOFF mode only.
	2. 22-10-33 Fig. 104 Fault 8
22 10 09 00	1. NOT USED.
22 10 10 00	1. NOT USED.
22 10 11 __	1. With TAKEOFF mode engaged, moving (01=CAPT, 02=F/O) control column (pitch) disengages either AP. Both AP normal with other control column movement.
	2. 22-10-33 Fig. 106 Fault 11
22 10 12 __	1. With TAKEOFF mode engaged, turning (01=CAPT, 02=F/O) control wheel (roll) disengages either AP. Both AP normal with other control wheel movement.
	2. 22-10-33 Fig. 106 Fault 12
22 10 13 __	1. With TAKEOFF mode engaged, moving either control column (pitch) disengages (05=AP A, 06=AP B). Other AP operates normal with control column movement.
	2. 22-10-33 Fig. 106 Fault 13
22 10 14 __	1. With TAKEOFF mode engaged, turning control wheel (roll) disengages (05=AP A, 06=AP B). Other AP normal with control wheel movement.
	2. 22-10-33 Fig. 106 Fault 14

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 15 __	1. (05=AP A, 06=AP B) bat handle can be set to CWS or CMD but drops to OFF immediately or at any time after engagement. (Pitch or roll input command may be required to disengage AP.) 2. 22-10-33 Fig. 106 Fault 15
22 10 16 __	1. A/P LIMIT message with (05=AP A, 06=AP B) engaged in CWS or CMD. AP bat handle drops to OFF any time after engagement. (Pitch input may be required to disengage AP.) System normal when other AP engaged. 2. 22-10-33 Fig. 106 Fault 16
22 10 17 00	1. NOT USED.
22 10 18 00	1. NOT USED.
22 10 19 00	1. NOT USED.
22 10 20 00	1. NOT USED.
22 10 21 __	1. (01=CAPT, 02=F/O) ADI artificial horizon shows quick excursions of 3-5 degrees in pitch or roll. AP (same side) follows. Other ADI and AP normal. 2. 22-10-33 Fig. 108 Fault 21
22 10 22 __	1. (01=CAPT, 02=F/O) HSI compass card shows quick excursions of 3 - 5 degrees in heading. AP (same side) follows. Other HSI and AP normal. 2. 22-10-33 Fig. 108 Fault 22
22 10 23 __	1. No CWS pitch response with either control wheel, (05=AP A, 06=AP B) engaged. Other AP normal. 2. 22-10-33 Fig. 108 Fault 23

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 24 __	1. No CWS pitch response with Capt control wheel, (O5=AP A, O6=AP B) engaged. Other control wheel normal.
	2. 22-10-33 Fig. 108 Fault 24
22 10 25 __	1. No CWS pitch response with F/O control wheel, (O5=AP A, O6=AP B) engaged. Other control wheel is normal.
	2. 22-10-33 Fig. 108 Fault 25
22 10 26 __	1. No CWS roll response with either control wheel, (O5=AP A, O6=AP B) engaged. Other AP normal.
	2. 22-10-33 Fig. 108 Fault 26
22 10 27 __	1. No CWS roll response with Capt control wheel, (O5=AP A, O6=AP B) engaged. Other control wheel normal.
	2. 22-10-33 Fig. 108 Fault 27
22 10 28 __	1. No CWS roll response with F/O control wheel, (O5=AP A, O6=AP B) engaged. Other control wheel normal.
	2. 22-10-33 Fig. 108 Fault 28
22 10 29 __	1. A/P LIMIT message with (O5=AP A, O6=AP B) engaged. AP will follow VS input command. A/P LIMIT message out-of-view when other AP engaged.
	2. 22-10-33 Fig. 108 Fault 29
22 10 30 __	1. A/P LIMIT message with (O5=AP A, O6=AP B) engaged. AP will not follow VS pitch input command. A/P LIMIT message is out-of-view when other AP engaged.
	2. 22-10-33 Fig. 108 Fault 30

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 31 00	1. A/P LIMIT message with either AP engaged. Both AP follow VS pitch input command.
	2. 22-10-33 Fig. 106 Fault 31
22 10 32 __	1. Incorrect CWS pitch response with either control wheel, (05=AP A, 06=AP B) engaged. Other AP normal. (Example: In cruise with AP A engaged in CWS, if pitch up or down command is initiated, AP initially resists control input then responds properly. Other AP normal.)
	2. 22-10-33 Fig. 108 Fault 32
22 10 33 __	1. Incorrect CWS roll response with either control wheel, (05=AP A, 06=AP B) engaged. Other AP normal. (Example: in cruise with an AP engaged in CWS, if right turn initiated, AP initially resists control input and attempts to turn acft left before responding properly, or without heading selected, AP will start slow left or right turn. Other AP normal.)
	2. 22-10-33 Fig. 108 Fault 33
22 10 34 __	1. AP A and B trips from CMD to CWS with very little turn pressure on (01=CAPT, 02=F/O) control wheel. Other control wheel normal.
	2. 22-10-33 Fig. 108 Fault 34
22 10 35 __	1. (05=AP A, 06=AP B) trips from CMD to CWS with very little turn pressure on both control wheels.
	2. 22-10-33 Fig. 106 Fault 35
22 10 36 __	1. (05=AP A, 06=AP B) will not trip from CMD to CWS with over 15 pounds of turn force applied to Capt control wheel. Other control wheel normal.
	2. 22-10-33 Fig. 108 Fault 36

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 37 __	1. (05=AP A, 06=AP B) will not trip from CMD to CWS with over 15 pounds of turn force applied to F/O control wheel.
	2. 22-10-33 Fig. 108 Fault 37
22 10 38 __	1. (05=AP A, 06=AP B) will not trip from CMD to CWS with over 15 pounds of turn force applied to both control wheels.
	2. 22-10-33 Fig. 108 Fault 38
22 10 39 00	1. AP A and B pitch mode (VS, ALT, IAS, MACH) will not release with 15 pounds of pitch force applied to Capt control wheel. Other control wheel normal.
	2. 22-10-33 Fig. 108 Fault 39
22 10 40 00	1. AP A and B pitch mode (VS, ALT, IAS, MACH) will not release with 15 pounds of pitch force applied to F/O control wheel. Other control wheel normal.
	2. 22-10-33 Fig. 108 Fault 40
22 10 41 00	1. AP A and B pitch mode (VS, ALT, IAS, MACH) will not release with 15 pounds of pitch force applied to both control wheels.
	2. 22-10-33 Fig. 108 Fault 40A
22 10 42 __	1. (05=AP A, 06=AP B) has abnormal response in all pitch modes. Other AP normal.
	2. 22-11-02 Replace pitch computer No. 1 or 2

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 43 __	1. (05=AP A, 06=AP B) has abnormal response in all roll modes. Other AP normal. 2. 22-13-01 Replace roll computer No. 1 or 2
22 10 44 __	1. (05=AP A, 06=AP B) in CWS or CMD mode without heading selected, acft will start a slow left or right turn. Other AP normal. 2. 22-10-33 Fig. 108 Fault 33
22 10 45 00	1. NOT USED.
22 10 46 00	1. NOT USED.
22 10 47 00	1. NOT USED.
22 10 48 __	1. (05=AP A, 06=AP B) has abnormal response in NAV (VOR) mode. 2. 22-13-35 Fault Isolation
22 10 49 __	1. (05=AP A, 06=AP B) has abnormal response in LOC mode. 2. 22-12-19 Fig. 103 Block 1
22 10 50 __	1. (05=AP A, 06=AP B) has abnormal response in APR mode. 2. 22-12-21 Fault Isolation
22 10 51 __	1. FD flag and CMD bar in-view on (01=CAPT, 02=F/O) ADI. Both AP and FD turned-off. 2. 22-10-31 Fig. 104 Fault 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 52 __	1. FD flag in-view on (01=CAPT, 02=F/O) ADI. Both AP and both FD turned-off. 2. 22-10-31 Fig. 104 Fault 2
22 10 53 __	1. CMD bar in-view on (01=CAPT, 02=F/O) ADI. Both AP and FD turned-off. 2. 22-10-31 Fig. 103 Fault 3 22-10-31 Fig. 104 Fault 3
22 10 54 00	1. NOT USED.
22 10 55 00	1. NOT USED.
22 10 56 00	1. NOT USED.
22 10 57 00	1. NOT USED.
22 10 58 00	1. NOT USED.
22 10 59 00	1. NOT USED.
22 10 60 00	1. NOT USED.
22 10 61 __	1. FD flag in-view, CMD bar out-of-view, and ATT flag in-view on (01=CAPT, 02=F/O) ADI. Both FD engaged. AP (same side) will not engage. 2. 22-10-31 Fig. 105 Fault 11
22 10 62 __	1. FD flag in-view and CMD bar out-of-view on (01=CAPT, 02=F/O) ADI. HDG flag in-view on HSI (same side) and RDDMI (opposite side). AP (same side) will not engage. Both FD turned-on. 2. 22-10-31 Fig. 105 Fault 12

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 63 __	1. FD flag in-view and CMD bar out-of-view on (O1=CAPT, O2=F/O) ADI. MACH flag in-view on AS/MACH indicator (same side). SSC flag in-view on baro alt (same side). AP (same side) locked-out of CMD. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 13
22 10 64 __	1. FD flag in-view, CMD bar out-of-view on (O1=CAPT, O2=F/O) ADI. AP (same side) can be engaged. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 14
22 10 65 __	1. FD flag in-view and CMD bar out-of-view on (O1=CAPT, O2=F/O) ADI. AP (same side) will not engage. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 15
22 10 66 __	1. FD flag in-view, CMD bar out-of-view on (O1=CAPT, O2=F/O) ADI. AP (same side) locked-out of CMD position. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 16
22 10 67 __	1. (O1=CAPT, O2=F/O) ADI CMD bar does not follow other ADI bar in pitch. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 17
22 10 68 __	1. (O1=CAPT, O2=F/O) ADI does not follow other ADI bar when acft roll is less than 3 deg. Both FD turned-on. System normal when acft roll greater than 3 deg and FD synced.
	2. 22-10-31 Fig. 105 Fault 18
22 10 69 __	1. (O1=CAPT, O2=F/O) ADI CMD bar does not follow other ADI bar in roll. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 19

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 70 __	1. FD flag in-view on (O1=CAPT, O2=F/O) ADI and CMD bar does not follow other ADI bar in pitch. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 20
22 10 71 __	1. FD flag in-view on (O1=CAPT, O2=F/O) ADI and CMD bar does not follow other ADI bar in roll. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 21
22 10 72 __	1. FD flag jitters in- and out-of-view on (O1=CAPT, O2=F/O) ADI. Both FD turned-on.
	2. 22-10-31 Fig. 105 Fault 22
22 10 73 __	1. CMD bar will not sync to new attitude on (O1=CAPT, O2=F/O) ADI with one FD switch.
	2. 22-10-31 Fig. 105 Fault 23
22 10 74 __	1. CMD bar will not sync to new attitude on (O1=CAPT, O2=F/O) ADI with either FD switch.
	2. 22-10-31 Fig. 105 Fault 24
22 10 75 __	1. Aircraft porpoises when (O5=AP A, O6=AP B) is engaged in a pitch mode (ALT, VS or IAS hold). No other cockpit indications.
	2. 22-10-33 Fig. 109 Fault 41
22 10 76 __	1. Aircraft porpoises when (O5=AP A, O6=AP B) is engaged in a pitch CMD mode (ALT, VS or IAS hold). CADC instruments (same side) are erratic or do not agree with other side.
	2. 22-10-33 Fig. 109 Fault 42

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 10 77 __	1. Aircraft porpoises when (05=AP A, 06=AP B) is engaged. No pitch CMD modes engaged.
	2. 22-10-33 Fig. 109 Fault 43
22 10 78 __	1. Aircraft porpoises when (05=AP A, 06=AP B) is engaged. No pitch CMD modes engaged. ADI artificial horizon (same side) may show quick excursions of 3-5 degrees in pitch and roll.
	2. 22-10-33 Fig. 109 Fault 44
22 10 79 00	1. Aircraft porpoises when either autopilot is engaged. OK when one pitch trim system is turned off. (Control column moves approximately 1 inch in 2-3 seconds.)
	2. 22-10-33 Fig. 109 Fault 45
22 10 80 00	1. Aircraft porpoises when either autopilot is engaged. (Control column moves approximately 1 inch in 2-3 seconds.)
	2. 22-10-33 Fig. 109 Fault 46
22 10 81 __	1. Control column buzz when (05=AP A, 06=AP B) is engaged. Control column normal when other autopilot engaged.
	2. 22-10-33 Fig. 110 Fault 47
22 10 82 00	1. Control column buzz when either autopilot is engaged.
	2. 22-10-33 Fig. 110 Fault 48
22 11 01 __	1. When VS mode engaged, (05=AP A, 06=AP B) bat handle drops from CMD to CWS. FD flag (ADI same side) comes in-view. System normal when other AP engaged.
	2. 22-11-31 Fig. 104 Fault 12

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 02 __	1. When VS mode engaged, VS message did not appear on (O1=CAPT, O2=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 1. AP (same side) follows vertical speed. 2. 22-11-31 Fig. 104 Fault 13
22 11 03 __	1. When VS mode engaged, VS message did not appear on (O1=CAPT, O2=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 1. AP (same side) will not pitch to maintain proper vertical speed. 2. 22-11-31 Fig. 104 Fault 14
22 11 04 __	1. With (O5=AP A, O6=AP B) turned on, and VS mode engaged, acft climbs or descends at different rate (as indicated on vertical speed indicator) than VS selected. When other AP engaged, acft climb and descent normal. Capt and F/O ADI CMD bars do not track together in either case. 2. 22-11-31 Fig. 104 Fault 11
22 11 05 __	1. FD flag in-view and CMD bar out-of-view on (O1=CAPT, O2=F/O) ADI. Both FD engaged in VS mode. AP (same side) drops from CMD to CWS (CMD DISC) if turned-on. 2. 22-11-31 Fig. 104 Fault 12
22 11 06 __	1. VS mode not displayed on (O1=CAPT, O2=F/O) AFCS MODES ann. Both FD engaged in VS mode. ADI CMD bar (same side) follows thumbwheel in pitch. 2. 22-11-31 Fig. 104 Fault 13

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 07 __	1. VS mode not displayed on (O1=CAPT, O2=F/O) AFCS MODES ann. Both FD engaged in VS mode. ADI CMD bar (same side) does not follow thumbwheel in pitch.
	2. 22-11-31 Fig. 104 Fault 14
22 11 08 00	1. VS mode light does not come on when depressed. VS messages in-view.
	2. 22-11-31 Fig. 104 Fault 15
22 11 09 00	1. Both ADI CMD bars do not follow thumbwheel (wheel spins free). Both FD engaged in VS mode. If either AP engaged, unable to control rate of climb.
	2. 22-11-31 Fig. 104 Fault 16
22 11 10 00	1. When VS mode engaged, VERT SPEED tape slips when desired vertical speed selected manually by thumbwheel. (Wheel spins free.)
	2. 22-11-31 Fig. 104 Fault 17
22 11 11 __	1. (O1=CAPT, O2=F/O) ADI CMD bar does not follow thumbwheel, other ADI bar does follow in pitch. Both FD engaged in VS mode.
	2. 22-11-31 Fig. 104 Fault 18
22 11 12 00	1. Vertical speed tape on Heading/Pitch Mode panel does not zero when indicated VS is zero. VS mode not engaged.
	2. 22-11-31 Fig. 104 Fault 1
22 11 13 00	1. Vertical speed tape on Heading/Pitch Mode panel does not drive to indicate VS. VS mode not engaged.
	2. 22-11-31 Fig. 104 Fault 2

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 14 00	1. Vertical speed tape on Heading/Pitch Mode panel drives past indicated VS. VS mode not engaged.
	2. 22-11-31 Fig. 104 Fault 3
22 11 15 00	1. ALTITUDE SELECT knob stuck, loose, frozen.
	2. 22-11-35 Fig. 104 Fault 1
22 11 16 __	1. Flag covers ALTITUDE SELECT window when air data source knob set to (09=NORM, 10=STBY) position. Flag out-of-view in other knob position. STALL WARN, ATS, DLC/AUTO SPLR, etc. (same side) FAIL lights on.
	2. 22-11-35 Fig. 104 Fault 2
22 11 17 __	1. Flag covers ALTITUDE SELECT window when air data source knob set to (09=NORM, 10=STBY) position. Flag out-of-view in other knob position. Baro alt (same side) OFF flag in-view.
	2. 22-11-35 Fig. 104 Fault 3
22 11 18 __	1. Flag covers ALTITUDE SELECT window when air data source knob set to (09=NORM, 10=STBY) position. Flag out-of-view in other knob position. Baro Alt (same side) OFF flag out-of-view.
	2. 22-11-35 Fig. 104 Fault 4
22 11 19 00	1. Flag covers ALTITUDE SELECT window with air data source knob in NORM and STBY position.
	2. 22-11-35 Fig. 104 Fault 5
22 11 20 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 21 __	1. AP/FD does not capture the altitude that is armed for capture in the ALTITUDE SELECT windcw with air data source knob in (09=NORM, 10=STBY) position. Sys normal in other knob position.
	2. 22-11-35 Fig. 104 Fault 11
22 11 22 00	1. NOT USED.
22 11 23 __	1. (13=AP/FD A, 14=AP/FD B) does not capture altitude that is armed for capture in the ALTITUDE SELECT window. Other system normal.
	2. 22-11-35 Fig. 104 Fault 13
22 11 24 __	1. Both AP/FD do not capture the altitude that is armed for capture in the ALTITUDE SELECT Window with air data source knob in (09=NORM, 10=STBY) position. Both ADI did not indicate level off at selected altitude. System normal in other knob position.
	2. 22-11-35 Fig. 104 Fault 14
22 11 25 __	1. ALT ARM message not displayed on (01=CAPT, 02=F/O) AFCS MODES ann when altitude select ARM mode engaged.
	2. 22-11-35 Fig. 104 Fault 15
22 11 26 __	1. ALTITUDE SELECT ARM light does not come on when depressed with air data source knob in (09=NORM, 10=STBY) position. System OK in other knob position.
	2. 22-11-35 Fig. 104 Fault 16
22 11 27 00	1. ALTITUDE SELECT ARM light does not come on when depressed with air data source knob in both NORM and STBY position.
	2. 22-11-35 Fig. 104 Fault 17

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 28 00	1. ALTITUDE SELECT ARM light comes on momentarily, then ALT hold light comes on.
	2. 22-11-35 Fig. 104 Fault 18
22 11 29 00	1. Altitude select ARM light does not come on when depressed. ALT ARM messages in-view.
	2. 22-11-35 Fig. 104 Fault 19
22 11 30 00	1. NOT USED.
22 11 31 __	1. ALT ARM message drops out in (09=NORM, 10=STBY) before altitude capture.
	2. 22-11-35 Fig. 104 Fault 20
22 11 32 __	1. (05=AP A, 06=AP B) bat handle drops to OFF at altitude capture. FD flag in-view on ADI (same side). Other AP and FD operation normal.
	2. 22-11-33 Fig. 104 Fault 2
22 11 33 __	1. (01=CAPT, 02=F/O) ADI CMD bar does not follow other ADI bar in pitch. Both FD engaged in IAS mode.
	2. 22-11-37 Fig. 104 Fault 1
22 11 34 __	1. FD flag in-view and CMD bar out-of-view on (01=CAPT, 02=F/O) ADI. Both FD engaged in IAS mode. AP (same side) drops from CMD to CWS (CMD DISC) if turned-on.
	2. 22-11-37 Fig. 104 Fault 2
22 11 35 __	1. IAS mode not displayed on (01=CAPT, 02=F/O) AFCS MODES ann. Both FD engaged in IAS mode. ADI CMD bar (same side) follows other CMD bar in pitch.
	2. 22-11-37 Fig. 104 Fault 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 36 __	1. IAS mode not displayed on (O1=CAPT, O2=F/O) AFCS MODES ann. Both FD engaged in IAS mode. ADI CMD bar (same side) does not follow other CMD bar in pitch. 2. 22-11-37 Fig. 104 Fault 4
22 11 37 00	1. IAS mode light does not come on when depressed. IAS messages in-view. 2. 22-11-37 Fig. 104 Fault 5
22 11 38 __	1. With (O5=AP A, O6=AP B) in CMD and IAS mode engaged, acft will not respond to the IAS pitch mode (will not change pitch attitude to accommodate IAS). Other AP normal. When FD are engaged, Capt and F/O ADI CMD bars do not track together. 2. 22-11-37 Fig. 104 Fault 1
22 11 39 __	1. When in IAS mode, (O5=AP A, O6=AP B) will not pitch to maintain proper speed profile. System normal when other AP engaged. 2. 22-11-37 Fig. 104 Fault 1
22 11 40 __	1. When IAS mode engaged, (O5=AP A, O6=AP B) bat handle drops from CMD to CWS. FD flag (ADI same side) comes in-view. System rormal when other AP engaged. 2. 22-11-37 Fig. 104 Fault 2
22 11 41 __	1. When IAS mode engaged, IAS message did not appear on (O1=CAPT, O2=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 1. 2. 22-11-37 Fig. 104 Fault 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 42 __	1. When IAS mode engaged, IAS message did not appear on (O1=CAPT, O2=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 1. AP (Same side) will not pitch to maintain proper speed profile. 2. 22-11-37 Fig. 104 Fault 4
22 11 43 __	1. (O1=CAPT, O2=F/O) ADI CMD bar does not follow other ADI bar in pitch. Both FD engaged in MACH mode. 2. 22-11-39 Fig. 104 Fault 1
22 11 44 __	1. FD flag in-view and CMD bar out-of-view on (O1=CAPT, O2=F/O) ADI. Both FD engaged in MACH mode. AP (same side) drops from CMD to CWS (CMD DISC) if turned-on. 2. 22-11-39 Fig. 104 Fault 2
22 11 45 __	1. MACH mode not displayed on (O1=CAPT, O2=F/O) AFCS MODES ann. Both FD engaged in MACH mode. ADI CMD bar (same side) follows other CMD bar in pitch. 2. 22-11-39 Fig. 104 Fault 3
22 11 46 __	1. MACH mode not displayed on (O1=CAPT, O2=F/O) AFCS MODES ann. Both FD engaged in MACH mode. ADI CMD bar (same side) does not follow other CMD bar in pitch. 2. 22-11-39 Fig. 104 Fault 4
22 11 47 00	1. MACH mode light does not come on when depressed. MACH messages in-view. 2. 22-11-39 Fig. 104 Fault 5

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 48 __	1. When in MACH mode, (05=AP A, 06=AP B) will not pitch to maintain proper speed profile. System normal when other AP engaged.
	2. 22-11-39 Fig. 104 Fault 1
22 11 49 __	1. When MACH mode engaged, (05=AP A, 06=AP B) bat handle drops from CMD to CWS. FD flag (ADI same side) comes in-view. System normal when other AP engaged.
	2. 22-11-39 Fig. 104 Fault 2
22 11 50 __	1. When MACH mode engaged, MACH message did not appear on (01=CAPT, 02=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 2.
	2. 22-11-39 Fig. 104 Fault 3
22 11 51 __	1. When MACH mode engaged, MACH message did not appear on (01=CAPT, 02=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 2. AP (same side) will not pitch to maintain proper speed profile.
	2. 22-11-39 Fig. 104 Fault 4
22 11 52 __	1. (01=CAPT, 02=F/O) ADI CMD bar does not follow other ADI bar in pitch. Both FD engaged in ALT mode.
	2. 22-11-33 Fig. 104 Fault 1
22 11 53 __	1. FD flag in-view and CMD bar out-of-view on (01=CAPT, 02=F/O) ADI. Both FD engaged in ALT mode. AP (same side) drops from CMD or CWS to OFF (AP DISC) if turned-on.
	2. 22-11-33 Fig. 104 Fault 2

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 54 __	1. ALT mode not displayed on (01=CAPT, 02=F/O) AFCS MODES ann. Both FD engaged in ALT mode. ADI CMD bar (same side) follows other CMD bar in pitch. 2. 22-11-33 Fig. 104 Fault 3
22 11 55 __	1. ALT mode not displayed on (01=CAPT, 02=F/O) AFCS MODES ann. Both FD engaged in ALT mode. ADI CMD bar (same side) does not follow other CMD bar in pitch. 2. 22-11-33 Fig. 104 Fault 4
22 11 56 00	1. ALT mode light does not come on when depressed. Messages are in-view. 2. 22-11-33 Fig. 104 Fault 5
22 11 57 00	1. NOT USED.
22 11 58 00	1. NOT USED.
22 11 59 00	1. NOT USED.
22 11 60 00	1. NOT USED.
22 11 61 00	1. NOT USED.
22 11 62 00	1. NOT USED.
22 11 63 00	1. NOT USED.
22 11 64 00	1. NOT USED.
22 11 65 00	1. NOT USED.
22 11 66 00	1. NOT USED.
22 11 67 00	1. NOT USED.
22 11 68 00	1. NOT USED.
22 11 69 00	1. NOT USED.

R R 050B EFFECTIVITY: ALL

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 70 00	1. NOT USED.
22 11 71 00	1. NOT USED.
22 11 72 00	1. NOT USED.
22 11 73 __	1. Force required for control wheel movement was not increased in TURB mode with (05=AP A, 06=AP B) engaged. System normal when other AP engaged. 2. 22-11-43 Fig. 104 Fault 1
22 11 74 __	1. Force required for control column movement was not increased in TURB mode with (05=AP A, 06=AP B) engaged. System operates normal when other AP engaged. 2. 22-11-43 Fig. 104 Fault 2
22 11 75 __	1. When TURB mode is engaged, TURB message did not appear on (01=CAPT, 02=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 1. 2. 22-11-43 Fig. 104 Fault 3
R 22 11 76 __ R R	1. (03=AP A, 06=AP B, 03=Both) will not accept TURB mode. Affected autopilot(s) will accept CWS and CMD. 2. 22-11-43 Fig. 104 Fault 4
22 11 77 00	1. One of the following modes did not disengage, if engaged, when TURB engaged (IAS, MACH, ALT HOLD). (List mode not disengaged). 2. 22-11-43 Fig. 104 Fault 5
22 11 78 00	1. HDG SEL mode did not disengage when TURB mode engaged. 2. 22-11-43 Fig. 104 Fault 6

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 11 79 __	1. (01=CAPT, 02=F/O) ADI command bar did not bias out-of-view when TURB mode engaged.
	2. 22-11-43 Fig. 104 Fault 7
22 12 01 00	1. DANA light comes on immediately after either bat handle set to CWS or CMD from OFF, or during straight and level flight. No other flt sta indications.
	2. 22-12-37 Fig. 104 Fault 1
22 12 02 __	1. DANA light comes on immediately after AP bat handle set to CWS or CMD from OFF, or during straight and level flight. (01=CAPT, 02=F/O) radio alt flag in-view.
	2. 22-12-37 Fig. 104 Fault 2
22 12 03 __	1. DANA light comes on immediately after AP bat handle is set to CWS or CMD from OFF, or during straight and level flight with VOR frequency selected. When ILS freq selected; ILS flags appear on (01=CAPT 02=F/O) ADI and HSI (same side), and DANA can be turned OFF by cycling AP bat handle to OFF, then CWS or CMD.
	2. 22-12-37 Fig. 104 Fault 3
22 12 04 00	1. DANA light on immediately after AP bat handle set to CWS or CMD from OFF. After cycling both YAW SAS switchlights to OFF then on, and either AP bat handle to OFF, then CWS or CMD; DANA light went off and remained off for remainder of flight.
	2. 22-12-37 Fig. 104 Fault 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 12 05 __	1. DANA light on immediately after (05=AP A, 06=AP B) bat handle set to CWS or CMD from OFF, or during straight and level flight. There is no DANA light when other bat handle set to CWS or CMD from OFF. 2. 22-12-37 Fig. 104 Fault 5
22 12 06 __	1. DANA light on immediately after (05=AP A, 06=AP B) bat handle set to CWS or CMD from OFF, or during straight and level flight. Other AP locked-off (can't be engaged when first AP engaged is turned-off). No other flt sta indications. 2. 22-12-37 Fig. 104 Fault 6
22 12 07 __	1. DANA light on immediately after (05=AP A, 06=AP B) bat handle set to CWS or CMD from OFF, or during straight and level flight. Other AP bat handle locked-off. YAW SAS FAIL light (same side) comes on during turn coordination. 2. 22-12-37 Fig. 104 Fault 7
22 12 08 __	1. DANA light on immediately after (05=AP A, 06=AP B) bat handle is set to CWS or CMD from OFF, or during straight and level flight. Other AP bat handle locked-off. YAW SAS FAIL light (same side) on HARD FAIL. 2. 22-12-37 Fig. 104 Fault 8
22 12 09 00	1. NOT USED.
22 12 10 00	1. NOT USED.
22 12 11 __	1. DANA light on when (05=AP A, 06=AP B) bat handle in CMD and GO ARND mode engaged. No DANA light when other AP bat handle in CMD and GO ARND mode engaged. 2. 22-12-37 Fig. 105 Fault 11

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 12 12 __	1. DANA light on after GS message and prior to to A/L message. FD flag in-view on (01=CAPT, 02=F/O) ADI. AP bat handle (same side) drops to OFF.
	2. 22-12-37 Fig. 105 Fault 12
22 12 13 __	1. DANA light on after GS message and prior to A/L message. FD flag in-view on (01=CAPT, 02=F/O) ADI. AP bat handle (same side) drops to OFF. GS flags in-view on ADI and HSI (same side).
	2. 22-12-37 Fig. 105 Fault 13
22 12 14 00	1. DANA light on during turn coordination. DANA light can be turned off by cycling YAW SAS switchlights OFF then on, and then AP bat handle to OFF, then CWS or CMD during straight and level flight.
	2. 22-12-37 Fig. 105 Fault 14
22 12 15 00	1. DANA light on when pilot or AP is changing alt, and/or direction, and/or speed. During straight and level flight, DANA can be turned off by cycling either AP bat handle to OFF, then CWS or CMD.
	2. 22-12-37 Fig. 105 Fault 15
22 12 16 00	1. DANA light on at radio alt greater than 1500 feet. If AP bat handle set to OFF, then CWS or CMD when acft is below 1500 feet radio alt, DANA does not come on. Radio altm may disagree or GS raw data may disagree. (Add radio altimeter disagreement or GS raw data disagreement if observed.)
	2. 22-12-37 Fig. 105 Fault 16

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 13 01 __	1. (01=CAPT, 02=F/O) ADI CMD bar does not follow other ADI bar in roll. Both FD engaged in HDG SEL mode.
	2. 22-13-31 Fig. 104 Fault 3
22 13 02 __	1. FD flag in-view, and CMD bar out-of-view on (01=CAPT, 02=F/O) ADI. Both FD engaged in HDG SEL mode. AP (same side) drops from CMD to CWS if turned-on.
	2. 22-13-31 Fig. 104 Fault 4
22 13 03 __	1. HDG SEL mode not displayed on (01=CAPT, 02=F/O) AFCS modes ann. Both FD engaged in HDG SEL mode. ADI CMD bar (same side) follows other CMD bar in roll.
	2. 22-13-31 Fig. 104 Fault 5
22 13 04 __	1. HDG SEL mode not displayed on (01=CAPT, 02=F/O) AFCS MODES ann. Both FD engaged in HDG SEL mode. ADI CMD bar (same side) does not follow other CMD bar in roll.
	2. 22-13-31 Fig. 104 Fault 6
22 13 05 00	1. HDG mode light does not come on when depressed. Both HDG SEL messages in-view.
	2. 22-13-31 Fig. 104 Fault 7
22 13 06 __	1. Heading bug on (01=CAPT, 02=F/O) HSI does not agree with heading set in.
	2. 22-13-31 Fig. 104 Fault 2
22 13 07 00	1. HEADING set knob is loose, stuck, or frozen.
	2. 22-13-31 Fig. 104 Fault 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 13 08 --	1. When in HDG SEL mode, (05=AP A, 06=AP B) will not roll to maintain selected heading. System normal when other AP engaged.
	2. 22-13-31 Fig. 104 Fault 3
22 13 09 --	1. When HDG SEL mode engaged, (05=AP A, 06=AP B) bat handle drops from CMD to CWS. FD flag (ADI same side) comes in-view. System normal when other AP engaged.
	2. 22-13-31 Fig. 104 Fault 4
22 13 10 --	1. When HDG SEL mode engaged, HDG SEL message did not appear on (01=CAPT, 02=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 1.
	2. 22-13-31 Fig. 104 Fault 5
22 13 11 --	1. When HDG SEL mode engaged, HDG SEL message did not appear on (01=CAPT, 02=F/O) AFCS MODES ann. Message appears during AFCS MODES ann TEST 1. AP (same side) will not roll to maintain selected heading.
	2. 22-13-31 Fig. 104 Fault 6
22 14 01 --	1. During AUTOLAND engagement, one message (LOC ARM, GS ARM, or A/L ARM) did not appear (blank) on (01=CAPT, 02=F/O) AFCS MODES ann. Message displayed during AFCS MODES ann TEST 2. (List message not displayed.)
	2. 22-14-31 Fig. 104 Fault 1
22 14 02 --	1. During AUTOLAND engagement, only GS ARM message was displayed on (01=CAPT, 02=F/O) AFCS MODES ann. Other ann display normal. Messages displayed during AFCS MODES ann TEST 2.
	2. 22-14-31 Fig. 104 Fault 2

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 03 --	1. During AUTOLAND engagement, LOC message displayed as soon as A/L switchlight depressed. AP commands maneuver to center on LOC beam (as shown on HSI) when (05=AP A, 06=AP B) engaged FIRST.
	2. 22-14-31 Fig. 104 Fault 3
22 14 04 --	1. During AUTOLAND engagement, LOC message is displayed as soon as A/L switchlight depressed. AP does NOT command maneuver to center on LOC beam (as shown on HSI). (05=AP A, 06=AP B) was engaged FIRST.
	2. 22-14-31 Fig. 104 Fault 4
22 14 05 --	1. During AUTOLAND engagement, FD flag comes in-view on (01=CAPT, 02=F/O) ADI as soon as A/L switchlight depressed. AP bat handle (same side) drops to CWS if engaged FIRST. If bat handle (same side) engaged second, it drops to OFF when released. Radio alt FLAG in-view on radio alt indicator (same side). DANA light on.
	2. 22-14-31 Fig. 104 Fault 5
22 14 06 --	1. During AUTOLAND engagement, FD flag comes in-view on (01=CAPT, 02=F/O) ADI as soon as A/L switchlight depressed. AP bat handle (same side) drops to CWS if engaged FIRST. If bat handle (same side) engaged second, it drops to OFF when released. DANA LIGHT ON.
	2. 22-14-31 Fig. 104 Fault 6
22 14 07 --	1. During AUTOLAND engagement, (05=AP A, 06=AP B) bat handle drops to CWS. FD flag comes in view on ADI (same side). (Both VHF NAV control panels tuned to ILS frequency). When other bat handle engaged FIRST, AUTOLAND engagement normal.
	2. 22-14-31 Fig. 104 Fault 7

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 08 00	1. During AUTOLAND engagement, A/L light did not come on. All other flt sta indications normal.
	2. 22-14-31 Fig. 104 Fault 8
22 14 09 __	1. During AUTOLAND engagement FD flag comes in-view on (01=CAPT, 02=F/O) ADI as soon as A/L switchlight is pressed. AP bat handle (same side) drops to CWS if engaged FIRST. If bat handle (same side) engaged second, it drops to OFF when released. Radio alt FLAG in-view on radio alt indicator (same side).
	2. 22-14-31 Fig. 104 Fault 5
22 14 10 __	1. During AUTOLAND (at least 30 seconds after LOC capture but prior to A/L message), NO ALIGN message displayed. HSI compass cards disagree and (01=CAPT, 02=F/O, or 04=NEITHER) HDG flag in-view. After A/L message, ALIGN ARM, ALIGN and ROLLOUT messages were NOT displayed on AFCS MODES ann. ADI yaw steering pointers do not come in-view at ROLLOUT.
R	2. 34-22-00 Fig. 103 (Sheet 1) Block 1
R	32-14-31 Fig. 103 Fault 11
22 14 11 00	1. During AUTOLAND (at least 30 seconds after LOC capture but prior to A/L message), NO ALIGN message displayed. After A/L message, ALIGN ARM, ALIGN and ROLLOUT messages were NOT displayed on AFCS MODES ann. ADI yaw steering pointers do not come in-view at ROLLOUT.
	2. 22-14-31 Fig. 105 Fault 11
22 14 12 __	1. During AUTOLAND at LOC capture (01=CAPT, 02=F/O) AFCS MODES ann indicates LOC, other ann indicates LOC ARM.
	2. 22-14-31 Fig. 105 Fault 12

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 13 __	1. During AUTOLAND at LOC capture, (01=CAPT, 02=F/O) AFCS MODES ann indicates LOC, other ann blank. Correct message comes in-view during AFCS MODES TEST 1. 2. 22-14-31 Fig. 105 Fault 13
22 14 14 __	1. During AUTOLAND at LOC capture, GS message displayed immediately. AP commands a maneuver to center on GS beam (as shown on HSI) when (05=AP A, 06=AP B) engaged FIRST. 2. 22-14-31 Fig. 105 Fault 14
22 14 15 __	1. During AUTOLAND at LOC capture, GS message is displayed immediately. AP does NOT command maneuver to center on GS beam (as shown on HSI) when (05=AP A, 06=AP B) engaged first. 2. 22-14-31 Fig. 105 Fault 15
22 14 16 __	1. During AUTOLAND after LOC capture, (05=AP A, 06=AP B) bat handle drops to OFF and ADI (same side) has FD flag in view. When ILS frequency selected, LOC flags appeared on HSI (same side). DANA light on. NO DUAL message at A/L capture. 2. 22-14-31 Fig. 105 Fault 16
R 22 14 17 __ R R R	1. During AUTOLAND after LOC capture, (05=AP A, 06=AP B) bat handle drops to OFF and ADI (same side) has FD flag in-view. DANA light is on. NO DUAL message at A/L capture. 2. 22-14-31 Fig. 105 Fault 17
22 14 18 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 19 __	1. During AUTOLAND engagement FD flag comes in-view on (O1=CAPT, O2=F/O) ADI as soon as A/L switchlight is pressed. AP bat handle (same side) drops to CWS if engaged first. If bat handle (same side) engaged second it drops to OFF when released.
	2. 22-14-31 Fig. 104 Fault 6
22 14 20 __	1. During AUTOLAND after LOC capture (O5=AP A, O6=AP B) bat handle drops to OFF and ADI (same side) has FD flag in-view. When ILS frequency selected, LOC flags appeared on HSI (same side). NO DUAL message at A/L capture.
	2. 22-14-31 Fig. 105 Fault 16
22 14 21 00	1. During AUTOLAND at GS capture, NO GA message comes into view on AFCS WARNING indicators. No other flt sta indications.
	2. 22-14-31 Fig. 106 Fault 21
22 14 22 __	1. During AUTOLAND at GS capture, (O1=CAPT, O2=F/O) AFCS MODES ann indicates GS, other ann indicates GS ARM.
	2. 22-14-31 Fig. 106 Fault 22
22 14 23 __	1. During AUTOLAND at GS Capture, (O1=CAPT, O2=F/O) AFCS MODES ann indicates GS, other ann blank. Message comes in-view during AFCS MODES TEST 1.
	2. 22-14-31 Fig. 106 Fault 23
22 14 24 __	1. During AUTOLAND after GS capture, (O5=AP A, O6=AP B) bat handle drops to OFF and ADI (same side) has FD flag in-view. When ILS frequency was selected, GS flag appeared on HSI (same side). NO DUAL at A/L capture. DANA LIGHT ON.
	2. 22-14-31 Fig. 106 Fault 24

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 25 __	1. During AUTOLAND after GS capture, (05=AP A, 06=AP B) bat handle drops to OFF and ADI (same side) has FD flag in-view. NO DUAL message at A/L capture. DANA LIGHT ON.
	2. 22-14-31 Fig. 106 Fault 25
22 14 26 __	1. During AUTOLAND at GS capture, (01=CAPT, 02=F/O) ADI approach gate did not come in-view.
	2. 22-14-31 Fig. 106 Fault 26
22 14 27 __	1. During AUTOLAND after LOC capture, (05=AP A, 06=AP B) bat handle drops to OFF and ADI (same side) has FD flag in-view. NO DUAL message at A/L capture.
	2. 22-14-31 Fig. 105 Fault 17
22 14 28 00	1. During AUTOLAND at A/L Track, NO ALIGN message displayed. ALN ARM, ALIGN and ROLLOUT messages NOT displayed on AFCS MODES ann. ADI yaw pointers did NOT come into view.
	2. 22-14-31 Fig. 105 Fault 11
22 14 29 00	1. During AUTOLAND at A/L track, NO DUAL message displayed. Both PITCH TRIM and both MACH TRIM FAIL lights on. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
R R	2. 22-18-00 Fig. 104 Fault 11 (The latched DANA can recycling 1A6 and 1A24 circuit breakers.)

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 30 00	1. During AUTOLAND at A/L track, NO DUAL message displayed. Both PITCH TRIM FAIL lights on. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
R R	2. 22-18-00 Fig. 104 Fault 10 (The latched DANA can recycling 1A6 and 1A24 circuit breakers.)
22 14 31 __	1. During AUTOLAND at A/L track capture, (01=CAPT, 02=F/O) AFCS MODES ann indicates A/L, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 1.
	2. 22-14-31 Fig. 107 Fault 31
22 14 32 __	1. During AUTOLAND at A/L track capture, (01=CAPT, 02=F/O) AFCS MODES ann indicates ALN ARM, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 2.
	2. 22-14-31 Fig. 107 Fault 32
22 14 33 __	1. During AUTOLAND at A/L track capture, (01=CAPT, 02=F/O) AFCS MODES ann indicates FLR ARM, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 2.
	2. 22-14-31 Fig. 107 Fault 33
22 14 34 00	1. During AUTOLAND at A/L track and above 156 feet, both ALIGN messages came in-view instead of ALN ARM messages.
	2. 22-14-31 Fig. 107 Fault 34
22 14 35 __	1. During AUTOLAND at A/L track, NO DUAL message displayed. YAW SAS (11=SYS 1, 12=SYS 2) FAIL light on. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 35

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 36 00	1. During AUTOLAND at A/L track, NO DUAL message displayed. No other flt sta indications. (Latched DANA light comes on when airspeed is less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 36
22 14 37 __	1. During AUTOLAND at A/L track, NO DUAL message displayed. FD flags come in-view on (01=CAPT, 02=F/O) ADI after A/L track. One FLR ARM message on AFCS MODES ann (same side) blank. Radio alt indicator (same side) reads less than 50 feet. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 37
22 14 38 __	1. During AUTOLAND at A/L track, NO DUAL message displayed. FD flag came in-view on (01=CAPT, 02=F/O) ADI after A/L track. One FLR ARM message on AFCS MODES ann (same side) blank. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
R	2. 22-14-31 Fig. 107 Fault 30
22 14 39 __	1. During AUTOLAND at A/L track, NO DUAL message displayed. FD flag came in-view on (01=CAPT, 02=F/O) ADI after A/L track. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 39
22 14 40 00	1. During AUTOLAND at A/L track, NO DUAL message displayed. FD flags came in-view on both ADI after A/L track. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 40

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 41 __	1. During AUTOLAND, (05=AP A, 06=AP B,) disconnect during A/L track. NO DUAL message displayed. (List altitude of aircraft at DISC and time DISC occured after A/L captured.) (Latched DANA light on when airspeed less than 90 knots or AP turned off.)
	2. 22-14-31 Fig. 107 Fault 41
22 14 42 00	1. During AUTOLAND, both AP disconnect during A/L track. (List altitude of aircraft at DISC, and time DISC occured after A/L capture.)
	2. 22-14-31 Fig. 107 Fault 42
22 14 43 __	1. During AUTOLAND, A/L captures above 1500 ft radio alt 30 sec after GS capture. At A/L track both ALIGN messages came in-view and (01=CAPT, 02=F/O) FLR ARM message was blank on AFCS MODES ann. FD flags came in-view on both ADI. If in ATS mode, throttles retard at A/L track. (Latched DANA light comes on when airspeed is less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 43
22 14 44 __	1. During AUTOLAND, A/L capture above 1500 ft radio alt 30 sec after GS capture. At A/L track NO DUAL message displayed, and FLR ARM message blank on (01=CAPT, 02=F/O) AFCS MODES ann. FD flags came in-view on both ADI. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 44
22 14 45 __	1. During AUTOLAND after A/L capture, PITCH TRIM (11=SYS 1, 12=SYS 2) FAIL light came on. No other flt sta indication.
	2. 22-14-31 Fig. 107 Fault 45

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 46 __	1. During AUTOLAND at A/L track, NO DUAL message displayed. FD flag came in-view on (01=CAPT, 02=F/O) ADI after A/L track. Yaw steering pointer on ADI (same side) did not come in-view at ROLLOUT altitude. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 107 Fault 46
22 14 47 __	1. During AUTOLAND after GS capture, (05=AP A, 06=AP B) bat handle drops to OFF and ADI (same side) has FD flag in-view. When ILS frequency was selected, GS flag appeared on HSI (same side). NO DUAL at A/L capture.
	2. 22-14-31 Fig. 106 Fault 24
22 14 48 __	1. During AUTOLAND after GS capture, (05=AP A, 06=AP B) bat handle drops to OFF and ADI (same side) has FD flag in-view. NO DUAL message at A/L capture.
	2. 22-14-31 Fig. 106 Fault 25
22 14 49 00	1. NOT USED.
22 14 50 00	1. NOT USED.
22 14 51 __	1. During AUTOLAND at ALIGN, (01=CAPT, 02=F/O) AFCS MODES ann indicates ALIGN, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 1.
	2. 22-14-31 Fig. 108 Fault 51
22 14 52 00	1. During AUTOLAND, NO ALIGN message came in-view during ALIGN mode.
	2. 22-14-31 Fig. 108 Fault 52

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 53 00	1. During AUTOLAND at ALIGN, NO DUAL message displayed. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 108 Fault 53
22 14 54 __	1. During AUTOLAND at ALIGN, NO DUAL message displayed. (01=CAPT, 02=F/O) AFCS MODES ann indicates ALIGN, other ann blank. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 108 Fault 54
22 14 55 __	1. During AUTOLAND, (05=AP A, 06=AP B) disconnect during ALIGN. (Latched DANA light comes on when airspeed less than 90 knots or AP disconnected.)
	2. 22-14-31 Fig. 108 Fault 55
22 14 56 00	1. During AUTOLAND, both AP disconnect during ALIGN.
	2. 22-14-31 Fig. 108 Fault 56
22 14 57 00	1. NOT USED.
22 14 58 00	1. NOT USED.
22 14 59 00	1. NOT USED.
22 14 60 00	1. NOT USED.
22 14 61 00	1. During AUTOLAND at FLARE, ATS DISC and both ATS FAIL lights on.
	2. 22-14-31 Fig. 109 Fault 61

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 62 __	1. During AUTOLAND at FLARE, (01=CAPT, 02=F/O) AFCS MODES ann indicates FLARE, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 1. DANA RECALL. 2. 22-14-31 Fig. 109 Fault 62
22 14 63 __	1. During AUTOLAND at FLARE, (01=CAPT, 02=F/O) AFCS MODES ann indicates FLARE, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 1. No other flt sta indications. 2. 22-14-31 Fig. 109 Fault 63
22 14 64 __	1. During AUTOLAND at FLARE, (01=CAPT, 02=F/O) AFCS MODES ann indicates FLARE, other ann blank, then indicates FLARE approx. 5 feet lower than flare altitude. DANA RECALL. 2. 22-14-31 Fig. 109 Fault 64
22 14 65 00	1. NOT USED.
22 14 66 __	1. During AUTOLAND, (05=AP A, 06=AP B) disconnects during FLARE. DANA RECALL. 2. 22-14-31 Fig. 108 Fault 55
22 14 67 00	1. During AUTOLAND, both AP disconnect during FLARE. 2. 22-14-31 Fig. 108 Fault 56
22 14 68 00	1. NOT USED.
22 14 69 __	1. During AUTOLAND, (05=AP A, 06=AP B) disconnects during ROLLOUT. DANA RECALL. 2. 22-14-31 Fig. 108 Fault 55

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 70 00	1. During AUTOLAND, both AP disconnect during ROLLOUT.
	2. 22-14-31 Fig. 108 Fault 56
22 14 71 __	1. During AUTOLAND at ROLLOUT, (01=CAPT, 02=F/O) AFCS MODES ann indicates ROLLOUT, other ann is blank. Correct message comes in-view during AFCS MODES ann TEST 1. DANA RECALL.
	2. 22-14-31 Fig. 110 Fault 72
22 14 72 __	1. During AUTOLAND at ROLLOUT, (01=CAPT, 02=F/O) AFCS MODES ann indicates ROLLOUT, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 1.
	2. 22-14-31 Fig. 110 Fault 72
22 14 73 00	1. NOT USED.
22 14 74 00	1. NOT USED.
22 14 75 __	1. During AUTOLAND at ROLLOUT, (01=CAPT, 02=F/O) ADI yaw steering pointer inoperative and R/O flag in-view. No other flt sta indications.
	2. 22-14-31 Fig. 110 Fault 75
22 14 76 __	1. During AUTOLAND at ROLLOUT, (01=CAPT, 02=F/O) ADI yaw steering pointer inoperative. No other flt sta indications.
	2. 22-14-31 Fig. 110 Fault 76
22 14 77 __	1. During AUTOLAND at ROLLOUT, (01=CAPT, 02=F/O) ADI yaw steering pointer remained out-of-view. DANA RECALL.
	2. 22-14-31 Fig. 110 Fault 77

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	22 14 78 __	1. During AUTOLAND at ROLLOUT, (01=CAPT, 02=F/O) ADI yaw steering pointer remained out-of-view. No other flt sta indications.
		2. 22-14-31 Fig. 110 Fault 78
	22 14 79 __	1. During AUTOLAND at ROLLOUT, (01=CAPT, 02=F/O) ADI approach gate and FD CMD bar (same side) did not go out-of-view. Also, yaw steering pointer (same side ADI) does not come in-view.
		2. 22-14-31 Fig. 110 Fault 79
	22 14 80 00	1. NOT USED.
	22 14 81 00	1. NOT USED.
	22 14 82 00	1. NOT USED.
	22 14 83 00	1. NOT USED.
	22 14 84 00	1. NOT USED.
	22 14 85 00	1. NOT USED.
	22 14 86 00	1. NOT USED.
	22 14 87 00	1. NOT USED.
	22 14 88 00	1. NOT USED.
	22 14 89 00	1. NOT USED.
	22 14 90 00	1. NOT USED.
	22 14 91 00	1. During AUTOLAND at ROLLOUT, nose wheel slow getting on ground. DANA RECALL.
R		2. 221-4-31 Fig. 111 Fault 91

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 14 92 00	1. During AUTOLAND at ROLLOUT, nose wheel slow getting on ground. No other flt sta indications.
	2. 22-14-31 Fig. 111 Fault 92
22 14 93 00	1. During AUTOLAND at TOUCHDOWN, ATS DISC message with both ATS FAIL lights on. No other flt sta indications.
	2. 22-14-31 Fig. 111 Fault 93
22 14 94 __	1. During AUTOLAND at TOUCHDOWN, (01=CAPT, 02=F/O) ATS DISC message after throttles retard to IDLE position and ATS switch drops to OFF.
	2. 22-14-31 Fig. 111 Fault 94
22 14 95 00	1. DANA RECALL. No other flt sta indications.
	2. 22-14-31 Fig. 111 Fault 95
22 14 96 00	1. DANA light on with both AP turned OFF. DANA will not reset.
	2. 22-14-31 Fig. 111 Fault 96
22 15 01 00	1. NOT USED.
22 15 02 00	1. YAW SAS 1 FAIL light on at turn-on or with input command.
	2. 22-15-00 Fig. 104 Fault 1
22 15 03 00	1. YAW SAS 1 FAIL light on. AP A bat handle locked-off.
	2. 22-15-00 Fig. 104 Fault 2
22 15 04 00	1. YAW SAS 1 FAIL light did not auto reset at eng 2 start. Will reset with switchlight.
	2. 22-15-00 Fig. 104 Fault 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 15 05 00	1. YAW SAS 2 FAIL light on at turn-on or with input command.
	2. 22-15-00 Fig. 104 Fault 4
22 15 06 00	1. YAW SAS 2 FAIL light on. AP B bat handle locked-off.
	2. 22-15-00 Fig. 104 Fault 5
R 22 15 07 00 R R	1. YAW SAS 2 FAIL light on. RUDDER HYDR LMTR light comes on when airspeed below 186 knots. (Rudder fusing has removed hydro A from servo.)
	2. 22-15-00 Fig. 104 Fault 7
22 15 08 00	1. YAW SAS 2 FAIL light did not auto reset at eng 1 start. Will reset with switchlight.
	2. 22-15-00 Fig. 104 Fault 6
22 15 09 00	1. Both YAW SAS FAIL lights come on at turn-on.
	2. 22-15-00 Fig. 104 Fault 9
22 15 10 00	1. Both YAW SAS FAIL lights come on during turn coordination with flaps up.
	2. 22-15-00 Fig. 104 Fault 10
22 15 11 00	1. Both YAW SAS FAIL lights come on during turn coordination with flaps down.
	2. 22-15-00 Fig. 104 Fault 11
22 15 12 __	1. Rudder pedals require excessive force to operate. Rudder pedal force normal when YAW SAS (33=SYS 1, 34=SYS 2, 35=SYS 1 & 2) turned off. (Ref. Chapter 27 for Fault Code diagram.)
	2. 22-15-00 Fig. 104 Fault 12
22 15 13 00	1. NOT USED.
22 15 14 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R 22 15 15 __	1. Full rudder travel unavailable with YAW SAS on. Rudder operation normal with YAW SAS (33=SYS 1, 34=SYS 2, 35=SYS 1 & 2) turned off. (Ref. Chapter 27 for Fault Code diagram.)
R	2. 22-15-00 Fig. 104 Fault 13
22 17 01 00	1. Control column does not shake during STALL WARN TEST with both systems on. Both STALL WARN FAIL lights out.
	2. 22-17-05 Fig. 104 Fault 1
22 17 02 __	1. (11=SYS 1, 12=SYS 2) FAIL light on during STALL WARN system TEST with other system OFF. Stick shaker normal.
	2. 22-17-05 Fig. 104 Fault 2 (Sys 1) 22-17-05 Fig. 104 Fault 3 (Sys 2)
22 17 03 00	1. NOT USED.
22 17 04 __	1. Control column does not shake during (11=SYS 1, 12=SYS 2) TEST with other system OFF. STALL WARN FAIL light off.
	2. 22-17-05 Fig. 104 Fault 4 (Sys 1) 22-17-05 Fig. 104 Fault 5 (Sys 2)
22 17 05 00	1. NOT USED.
22 17 06 __	1. Control column does not shake during (11=SYS 1, 12=SYS 2) TEST with other system OFF. STALL WARN FAIL light on.
	2. 22-17-05 Fig. 104 Fault 6 (Sys 1) 22-17-05 Fig. 104 Fault 7 (Sys 2)
22 17 07 00	1. NOT USED.
22 17 08 00	1. NOT USED.
22 17 09 00	1. NOT USED.
22 17 10 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 11 __	1. Control column shakes for no apparent reason (during rotation, in flight), both FAIL lights off. Fault was isolated to STALL WARN (11=SYS 1, 12=SYS 2) by switching one system off at a time. 2. 22-17-05 Fig. 105 Fault 10 (SYS 1) 22-17-05 Fig. 105 Fault 11 (SYS 2)
22 17 12 00	1. NOT USED.
22 17 13 __	1. Control column shakes for no apparent reason when flaps extended, both FAIL lights off. Fault isolated to STALL WARN system (11=SYS 1, 12=SYS 2) by switching one system off at a time. 2. 22-17-05 Fig. 105 Fault 12 (SYS 1) 22-17-05 Fig. 105 Fault 13 (SYS 2)
22 17 14 00	1. NOT USED.
22 17 15 __	1. STALL WARN (11=SYS 1, 12=SYS 2) FAIL light on, all other indications normal. FAIL remained on during flight. (Indicate when fail light came on.) 2. 22-17-05 Fig. 105 Fault 14 (SYS 1) 22-17-05 Fig. 105 Fault 15 (SYS 2)
22 17 16 00	1. NOT USED.
22 17 17 __	1. STALL WARN (11=SYS 1, 12=SYS 2) and ATS (same side) FAIL lights on. 2. 22-17-05 Fig. 105 Fault 16 (SYS 1) 22-17-05 Fig. 105 Fault 17 (SYS 2)
22 17 18 00	1. Both STALL WARN 1 and 2 FAIL lights on, all other indications normal. 2. 22-17-05 Fig. 105 Fault 18

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 19 __	1. Control column shakes for no apparent reason, and ATS FAIL lights on. Fault isolated to STALL WARN system (11=SYS 1, 12=SYS 2) by switching one system off at a time.
	2. 22-17-05 Fig. 105 Fault 19
22 17 20 __	1. When flaps selected to 4 degrees on ground, STALL WARN (11=SYS 1, 12=SYS 2) FAIL light comes on. System reset. OK on other flap selections.
	2. 22-17-05 Fig. 105 Fault 20
22 17 21 00	1. NOT USED.
22 17 22 00	1. NOT USED.
22 17 23 00	1. Altitude alert aural warning failed to sound when approaching selected altitude during ground test. All other indications normal.
	2. 22-17-06 Fig. 106 Fault 22
22 17 24 00	1. NOT USED.
22 17 25 00	1. NOT USED.
22 17 26 00	1. Altitude select knob on ALTITUDE SELECT panel jammed or loose.
	2. 22-17-06 Fig. 106 Fault 24
22 17 27 00	1. NOT USED.
22 17 28 00	1. DEVIATION ann failed to flash when deviating from selected altitude during ground test. All other indications normal.
	2. 22-17-06 Fig. 106 Fault 20

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 29 00	1. ALTITUDE ann failed to light at selected altitude during ground test. All other indications normal.
	2. 22-17-06 Fig. 106 Fault 21
22 17 30 00	1. APPROACH ann failed to light approaching selected altitude during ground test. All other indications normal.
	2. 22-17-06 Fig. 106 Fault 23
22 17 31 00	1. NOT USED.
22 17 32 00	1. DEVIATION ann came on early or late when acft deviated from selected altitude.
	2. 22-17-06 Fig. 105 Fault 20
22 17 33 00	1. NOT USED.
22 17 34 __	1. APPROACH ann remained on, ALTITUDE ann failed to light when acft reached selected altitude. System normal in (09=NORM, 10=STBY) position.
	2. 22-17-06 Fig. 104 Fault 1
22 17 35 __	1. ALTITUDE ann failed to come on when acft reached selected altitude. System normal in (09=NORM, 10=STBY) position.
	2. 22-17-06 Fig. 104 Fault 2
22 17 36 00	1. Altitude alert aural warning failed to sound during approach to selected altitude. All other indications normal.
	2. 22-17-06 Fig. 104 Fault 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 37 00	1. APPROACH ann failed to operate when acft approached selected altitude.
	2. 22-17-06 Fig. 104 Fault 5
22 17 38 00	1. NOT USED.
22 17 39 00	1. Flag in-view on ALTITUDE SELECT panel, no flags on Capt or F/O altimeters.
	2. 22-17-06 Fig. 104 Fault 6
22 17 40 __	1. Flag in-view on ALTITUDE SELECT panel, (SSC, OFF) flag in-view on (01=CAPT, 02=F/O) baro altimeters.
	2. 22-17-06 Fig. 104 Fault 7
22 17 41 00	1. ALTITUDE SELECT knob on ALTITUDE SELECT panel jammed or loose.
	2. 22-17-06 Fig. 104 Fault 8
22 17 42 00	1. Altitude alert aural warning failed to sound when deviating from selected altitude. All other indications normal.
	2. 22-17-06 Fig. 105 Fault 15
22 17 43 00	1. NOT USED.
22 17 44 00	1. Both (ALTITUDE, DEVIATION) ann on during selection of new altitude.
	2. 22-17-06 Fig. 105 Fault 17
22 17 45 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 46 00	1. Altitude alert aural warning came on early or late when acft deviated from selected altitude. 2. 22-17-06 Fig. 105 Fault 20A
22 17 47 00	1. APPROACH ann came on early or late when acft approached selected altitude. 2. 22-17-06 Fig. 104 Fault 12
22 17 48 00	1. ALTITUDE ann came on early or late when acft approached selected altitude. 2. 22-17-06 Fig. 104 Fault 11
22 17 49 00	1. NOT USED.
22 17 50 00	1. Altitude alert aural warning failed to sound during approach to selected altitude. ALTITUDE ann did not come on. 2. 22-17-06 Fig. 104 Fault 4
22 17 51 00	1. ALTITUDE ann did not flash when aircraft deviated from selected altitude. 2. 22-17-06 Fig. 105 Fault 16
22 17 52 00	1. NOT USED.
22 17 53 00	1. NOT USED.
22 17 54 00	1. NOT USED.
22 17 55 __	1. APPROACH and ALTITUDE ann flash continuously at selected altitude. System normal in (09=NORM, 10=STBY) position. 2. 22-17-06 Fig. 104 Fault 9
22 17 56 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 57 __	1. APPROACH ann comes on and aural warning sounds when vacating old altitude by 1000' for newly selected altitude. System operation normal in (09=NORM, 10=STBY) position. 2. 22-17-06 Fig. 103 Fault 10 22-17-06 Fig. 104 Fault 10
22 17 58 00	1. NOT USED.
22 17 59 __	1. DEVIATION ann flashes during selection of new altitude with air data source knob in (09=NORM, 10=STBY) position. System normal in other knob position. 2. 22-17-06 Fig. 105 Fault 18
22 17 60 __	1. DEVIATION ann flashes during climb/descent to new altitude with air data source knob in (09=NORM, 10=STBY) position. System normal in other knob position. 2. 22-17-06 Fig. 105 Fault 19
R 22 17 61 00 R	1. AUTO GND SPLRS INOP annunicator light on during DLC operation, DLC operation normal. 2. 22-17-07 Fig. 104 Fault 1
R 22 17 62 __ R R R	1. DLC/AUTO SPLR (11=SYS 1, 12=SYS 2) FAIL light on, will not reset in flight when 33 degrees flaps selected, all other indications and DLC operation normal. 2. 22-17-07 Fig. 104 Fault 2
22 17 63 __	1. DLC/AUTO SPLR (11=SYS 1, 12=SYS 2) FAIL light and associated STALL WARN FAIL light on, DLC operation normal. 2. 22-17-07 Fig. 104 Fault 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 64 00	1. DLC failed to operate, all FAIL lights off. 2. 22-17-07 Fig. 104 Fault 4
R 22 17 65 00 R R	1. DLC failed to operate, both DLC/AUTO SPLR FAIL and AUTO GND SPLRS INOP annunicator light on. 2. 22-17-07 Fig. 104 Fault 5
22 17 66 00	1. Speed brake auto disable light(s) on speed brake handle remain on, cycled switch with no effect. DLC did not operate and both DLC/AUTO SPLR FAIL lights on. 2. 22-17-07 Fig. 104 Fault 6
22 17 67 00	1. DLC failed to operate, both DLC/AUTO SPLR FAIL and STALL WARN FAIL lights on. 2. 22-17-07 Fig. 104 Fault 7
22 17 68 00	1. DLC failed to operate, cycled DLC/AUTO SPLR switches off and on but could not reset, both STALL WARN FAIL lights on. 2. 22-17-07 Fig. 104 Fault 8
22 17 69 00	1. NOT USED.
22 17 70 00	1. No AGS after landing, all FAIL lights off. 2. 22-17-07 Fig. 105 Fault 10
22 17 71 00	1. Both DLC/AUTO SPLR FAIL lights came on at touchdown, main gears touched down simultaneously. 2. 22-17-07 Fig. 105 Fault 11

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 72 00	1. Both DLC/AUTO SPLR FAIL lights came on at touchdown, left main gear touched down first.
	2. 22-17-07 Fig. 105 Fault 12
22 17 73 00	1. Both DLC/AUTO SPLR FAIL lights came on at touchdown, right main gear touched down first.
	2. 22-17-07 Fig. 105 Fault 13
22 17 74 00	1. Both DLC/AUTO SPLR FAIL lights came on during rollout, all other indications normal.
	2. 22-17-07 Fig. 105 Fault 14
22 17 75 00	1. AUTO GND SPLRS INOP ann came on during approach, DLC normal. Both DLC/AUTO SPLR FAIL lights came on at touchdown.
	2. 22-17-07 Fig. 105 Fault 15
22 17 76 00	1. Spoilers failed to operate during rejected takeoff. No AGSB FAIL lights on.
	2. 22-17-07 Fig. 105 Fault 16
22 17 77 00	1. Spoilers failed to operate during rejected takeoff, AUTO GND SPLRS INOP ann came on. No other FAIL indications.
	2. 22-17-07 Fig. 105 Fault 17
22 17 78 __	1. Spoilers failed to operate during rejected takeoff, AUTO GND SPLRS INOP ann and DLC/AUTO SPLR (11=SYS 1, 12=SYS 2, 03=BOTH) FAIL lights on.
	2. 22-17-07 Fig. 105 Fault 18

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 79 00	1. AUTO GND SPLRS INOP ann came on after takeoff.
	2. 22-17-07 Fig. 105 Fault 19
22 17 80 __	1. DLC/AUTO SPLR (11=SYS 1, 12=SYS 2) FAIL light came on at touchdown.
	2. 22-17-07 Fig. 105 Fault 20
22 17 81 __	1. (11=SYS 1, 12=SYS 2) PFCS MONITOR PITCH FAIL, ROLL FAIL, DLC/AUTO SPLR FAIL, STALL WARN FAIL lights came on, and ALT SELECT flag shown simultaneously.
	2. 22-17-09 Fig. 103 Fault 1
22 17 82 __	1. When hydr power applied to acft; (11=SYS 1, 12=SYS 2) PFCS MONITOR PITCH FAIL, ROLL FAIL, DLC/AUTO SPLR FAIL, and STALL WARN FAIL lights came on, and ALT SELECT flag shown simultaneously.
	2. 22-17-09 Fig. 103 Fault 2
22 17 83 __	1. When acft airborne and flaps positioned greater than 30 degrees; (11=SYS 1, 12=SYS 2) PFCS MONITOR PITCH FAIL, ROLL FAIL, DLC/AUTO SPLR FAIL, and STALL WARN FAIL lights came on, and ALT SELECT flag shown simultaneously.
	2. 22-17-09 Fig. 103 Fault 3
22 17 84 __	1. At touchdown; (11=SYS 1, 12=SYS 2) PFCS MONITOR PITCH FAIL, ROLL FAIL, DLC/AUTO SPLR FAIL, and STALL WARN FAIL lights came on, and ALT SELECT flag shown simultaneously.
	2. 22-17-09 Fig. 103 Fault 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 17 85 00	1. Speedbrake auto disable switch inoperative. (Ref. Chapter 27 for Fault Code diagram.)
	2. 22-17-00 Table 103 Test A
22 18 01 00	1. PITCH TRIM 1 FAIL light on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 1
22 18 02 00	1. PITCH TRIM 1, MACH TRIM 1, MACH FEEL 1 FAIL lights on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 2
22 18 03 00	1. PITCH TRIM 1 and DLC/AUTO SPLR 1 FAIL lights on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 3
22 18 04 00	1. PITCH TRIM 1 and DLC/AUTO SPLR 1 FAIL lights on. Left TRIM indicator on SPI always black. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 4
22 18 05 00	1. PITCH TRIM 1 and both MACH TRIM FAIL lights on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 5
22 18 06 00	1. PITCH TRIM 2 FAIL light on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 6
22 18 07 00	1. PITCH TRIM 2, MACH TRIM 2, MACH FEEL 2 FAIL lights on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 7

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 18 08 00	1. PITCH TRIM 2 and DLC/AUTO SPLR 2 FAIL lights on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 8
22 18 09 00	1. PITCH TRIM 2 and DLC/AUTO SPLR 2 FAIL lights on. Right TRIM indicator on SPI always black. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 9
22 18 10 00	1. Both PITCH TRIM FAIL lights on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 10
22 18 11 00	1. Both PITCH TRIM and both MACH TRIM FAIL lights on. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 11
22 18 12 00	1. Left TRIM indicator on SPI always black. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 12
22 18 13 00	1. Left TRIM indicator on SPI always yellow. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 12
22 18 14 00	1. Right TRIM indicator on SPI always black. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 14
22 18 15 00	1. Right TRIM indicator on SPI always yellow. (Auto trim.)
	2. 22-18-00 Fig. 104 Fault 15
22 18 16 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 18 17 __	1. (05=AP A, 06=AP B) selection trips pitch trim FAIL. 2. 22-18-00 Fault Isolation
22 18 18 00	1. NOT USED.
22 18 19 00	1. NOT USED.
22 18 20 00	1. NOT USED.
22 18 21 00	1. Without force on control wheel, manual trim wheel follows thumbwheel. AP A engaged in (CWS, CMD) with no modes engaged, and acft airborne. 2. 22-18-00 Fig. 105 Fault 21
22 18 22 00	1. Without force on control wheel, A/P LIMIT message in-view and manual trim wheel follows thumbwheel. AP A engaged in (CWS, CMD) with no modes engaged and acft airborne. 2. 22-18-00 Fig. 105 Fault 22
22 18 23 00	1. Without force on control wheel, manual trim wheel follows thumbwheel. AP B engaged in (CWS, CMD) with no modes engaged, and acft airborne. 2. 22-18-00 Fig. 105 Fault 23
22 18 24 00	1. Without force on control wheel, A/P LIMIT message is in-view and manual trim wheel follows thumbwheel. AP B engaged in (CWS, CMD) with no modes engaged, and acft airborne. 2. 22-18-00 Fig. 105 Fault 24
22 18 25 00	1. NOT USED.
22 18 26 00	1. NOT USED.
22 18 27 00	1. NOT USED.
22 18 28 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 18 29 00	1. NOT USED.
22 18 30 00	1. NOT USED.
22 18 31 00	1. PITCH TRIM 1 FAIL light on. Thumbwheel not rotated. (Manual pitch trim mode.) 2. 22-18-00 Fig. 106 Fault 31
22 18 32 00	1. PITCH TRIM 1, MACH TRIM 1, MACH FEEL 1 FAIL lights on. (Manual pitch trim mode.) 2. 22-18-00 Fig. 106 Fault 32
22 18 33 __	1. PITCH TRIM 1 FAIL light comes on when rotating (01=CAPT, 02=F/O 03=BOTH) thumbwheel(s). (Manual ovrd of auto trim.) 2. 22-18-00 Fig. 106 Fault 33
22 18 34 __	1. PITCH TRIM 1 FAIL light comes on when rotating (01=CAPT, 02=F/O 03=BOTH) thumbwheel(s). Both MACH TRIM fail lights on. (Manual ovrd of auto trim.) 2. 22-18-00 Fig. 106 Fault 34
22 18 35 00	1. PITCH TRIM 2 FAIL light on. (Thumbwheel not rotated.) (Manual pitch trim mode.) 2. 22-18-00 Fig. 106 Fault 35
22 18 36 00	1. PITCH TRIM 2, MACH TRIM 2, MACH FEEL 2 FAIL lights on. (Manual pitch trim mode.) 2. 22-18-00 Fig. 106 Fault 36
22 18 37 00	1. PITCH TRIM 2 FAIL light came on when rotating thumbwheel. (Manual ovrd of auto trim.) 2. 22-18-00 Fig. 106 Fault 37

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 18 38 00	1. Both PITCH TRIM FAIL lights on. Thumbwheel not rotated. (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 38
22 18 39 __	1. Both PITCH TRIM FAIL lights come on when rotating (01=CAPT, 02=F/O, 03=BOTH) thumbwheel(s). (Manual ovrd of auto trim.)
	2. 22-18-00 Fig. 106 Fault 39
22 18 40 __	1. When rotating thumbwheel, manual trim wheel does not follow. PITCH TRIM FAIL lights do not come on. (05=AP A, 06=AP B, 08=NEITHER AP) engaged when problem occurred. (Manual ovrd of auto trim.)
	2. 22-18-00 Fig. 106 Fault 40
22 18 41 00	1. Both PITCH TRIM FAIL lights come on when rotating thumbwheel. Both MACH TRIM FAIL lights on. (Manual ovrd of auto trim)
	2. 22-18-00 Fig. 106 Fault 41
22 18 42 00	1. When rotating either thumbwheel, manual trim wheel does not rotate smoothly, or it binds or jams. PITCH TRIM FAIL lights do not come on. (Manual ovrd of auto trim.)
	2. 22-18-00 Fig. 106 Fault 42
22 18 43 __	1. When rotating thumbwheel, manual trim wheel does not follow. PITCH TRIM FAIL lights do not come on. (05=AP A, 06=AP B, 08=NEITHER AP) engaged when problem occured. (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 40

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 18 44 00	1. When rotating either thumbwheel, manual pitch trim wheel does not rotate smoothly or it binds or jams. PITCH TRIM FAIL lights do not come on. (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 42
22 18 45 __	1. PITCH TRIM 1 FAIL light comes on when rotating (01=CAPT, 02=F/O, 03=BOTH) thumbwheel(s). (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 33
22 18 46 __	1. PITCH TRIM 1 FAIL light comes on when rotating (01=CAPT, 02=F/O, 03=BOTH) thumbwheel(s). Both MACH TRIM FAIL lights on. (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 34
22 18 47 __	1. PITCH TRIM 2 FAIL light came on when rotating (01=CAPT, 02=F/O, 03=BOTH) thumbwheel(s). (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 37
22 18 48 __	1. Both PITCH TRIM FAIL lights come on when rotating (01=CAPT, 02=F/O, 03=BOTH) thumbwheel(s). (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 39
22 18 49 __	1. Both PITCH TRIM FAIL lights came on when rotating (01=CAPT, 02=F/O, 03=BOTH) thumbwheel(s). Both MACH TRIM FAIL lights on. (Manual pitch trim mode.)
	2. 22-18-00 Fig. 106 Fault 41
22 21 01 00	1. MACH TRIM 1 FAIL light on.
	2. 22-21-00 Fig. 104 Fault 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 21 02 00	1. MACH TRIM 1, MACH FEEL 1 and PITCH TRIM 1 FAIL lights on. 2. 22-21-00 Fig. 104 Fault 2
22 21 03 00	1. MACH TRIM 1 and MACH FEEL 1 FAIL lights on. 2. 22-21-00 Fig. 104 Fault 3
22 21 04 00	1. MACH TRIM 1 and MACH FEEL 1 FAIL lights on. MACH flag in-view on Capt AIRSPEED/MACH indicator. 2. 22-21-00 Fig. 104 Fault 3A
22 21 05 00	1. MACH TRIM 2 FAIL light on. 2. 22-21-00 Fig. 104 Fault 4
22 21 06 00	1. MACH TRIM 2, MACH FEEL 2 and PITCH TRIM 2 FAIL lights on. 2. 22-21-00 Fig. 104 Fault 5
22 21 07 00	1. MACH TRIM 2 and MACH FEEL 2 FAIL lights on. 2. 22-21-00 Fig. 104 Fault 6
22 21 08 00	1. MACH TRIM 2 and MACH FEEL 2 FAIL lights on. MACH flag in-view on F/O AIRSPEED/MACH indicator. 2. 22-21-00 Fig. 104 Fault 6A
22 21 09 00	1. Both MACH TRIM FAIL lights on. Neither MACH TRIM 1 or 2 will operate with other channel OFF. 2. 22-21-00 Fig. 104 Fault 7

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 21 10 00	1. Both MACH TRIM FAIL lights on. Either MACH TRIM 1 or 2 will operate with other channel OFF.
	2. 22-21-00 Fig. 104 Fault 8
22 21 11 00	1. Both MACH TRIM FAIL lights on, and both MACH FEEL FAIL lights on. MACH TRIM/MACH FEEL 1 (2) will operate with other channel off.
	2. 22-21-00 Fig. 104 Fault 9
22 21 12 00	1. Both MACH TRIM FAIL lights on, and both MACH FEEL FAIL lights on. MACH TRIM/MACH FEEL 1 (2) will operate with other channel OFF.
	2. 22-21-00 Fig. 104 Fault 10
22 21 13 00	1. NOT USED.
22 21 14 00	1. NOT USED.
22 21 15 00	1. NOT USED.
22 21 16 00	1. NOT USED.
22 21 17 00	1. NOT USED.
22 21 18 00	1. NOT USED.
22 21 19 00	1. NOT USED.
22 21 20 00	1. NOT USED.
22 21 21 00	1. MACH FEEL 1 FAIL light on.
	2. 22-21-00 Fig. 105 Fault 21
22 21 22 00	1. MACH FEEL 2 FAIL light on.
	2. 22-21-00 Fig. 105 Fault 22

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	22 21 23 00	1. MACH FEEL 2 FAIL light on, and MACH indicator on flight control panel inoperative. 2. 22-21-00 Fig. 105 Fault 22A
R R	22 21 24 00	1. Both MACH FEEL FAIL lights on. MACH FEEL 1 (2) will not operate with other channel OFF. 2. 22-21-00 Fig. 105 Fault 23
	22 21 25 00	1. Both MACH FEEL FAIL lights on. MACH FEEL 1 (2) will operate with other channel OFF. 2. 22-21-00 Fig. 105 Fault 23A
	22 21 26 00	1. MACH indicator on flight control panel inoperative. 2. 22-21-00 Fig. 105 Fault 24
	22 31 01 00	1. ATS 1 FAIL light on. Capt FAST/SLOW needle out-of-view. 2. 22-31-00 Fig. 104 Fault 1
	22 31 02 00	1. ATS 1 FAIL light on and ALPHA flag in view. Capt FAST/SLOW needle out-of-view. AP A bat handle locked-off. 2. 22-31-00 Fig. 104 Fault 2
	22 31 03 00	1. ATS 1 and STALL WARN 1 FAIL lights on. Capt FAST/SLOW needle out-of-view. 2. 22-31-00 Fig. 104 Fault 3
	22 31 04 00	1. ATS 1 FAIL light and VERTICAL GYRO 3 ann on. Capt FAST/SLOW needle out-of-view. 2. 22-31-00 Fig. 104 Fault 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 31 05 00	1. ATS 1, MACH TRIM 1 and MACH FEEL 1 FAIL lights on. Capt FAST/SLOW needle out-of-view. Capt MACH/AIRSPEED indicator AS and MACH flags in-view. Capt Baro altm SSC flag in-view.
	2. 22-31-00 Fig. 104 Fault 5
22 31 06 00	1. ATS 2 FAIL light on. F/O FAST/SLOW needle out-of-view.
	2. 22-31-00 Fig. 104 Fault 6
22 31 07 00	1. ATS 2 FAIL light on. F/O FAST/SLOW needle out-of-view. AP B bat handle locked-off.
	2. 22-31-00 Fig. 104 Fault 7
22 31 08 00	1. ATS 2 FAIL light and ALPHA flag in view. F/O FAST/SLOW needle out-of-view. AP B bat handle locked-off.
	2. 22-31-00 Fig. 104 Fault 8
22 31 09 00	1. ATS 2 and STALL WARN 2 FAIL lights on. F/O FAST/SLOW needle out-of-view.
	2. 22-31-00 Fig. 104 Fault 9
22 31 10 00	1. ATS 2 FAIL light on, F/O FAST/SLOW needle out-of-view. F/O ADI ATT flag in-view.
	2. 22-31-00 Fig. 104 Fault 10
22 31 11 00	1. ATS 2, MACH TRIM 2 and MACH FEEL 2 FAIL lights on. F/O FAST/SLOW needle out-of-view. F/O MACH/AIRSPEED indicator AS and MACH flags in-view. F/O Baro altm SSC flag in-view.
	2. 22-31-00 Fig. 104 Fault 11
22 31 12 00	1. NOT USED.
22 31 13 00	1. NOT USED.
22 31 14 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	22 31 15 00	1. NOT USED.
	22 31 16 00	1. NOT USED.
	22 31 17 00	1. NOT USED.
	22 31 18 00	1. NOT USED.
	22 31 19 00	1. NOT USED.
R	22 31 20 00	1. Both ATS FAIL lights on and ATS DISC message in-view. Both FAST/SLOW needles out-of-view. ATS 1 (2) will operate with other channel off. 2. 22-31-00 Fig. 105 Fault 20
R	22 31 21 00	1. Both ATS FAIL lights on. ATS DISC message and ALPHA flag in-view. Both FAST/SLOW needles out-of-view. ATS 1 (2) will operate with other channel off. 2. 22-31-00 Fig. 105 Fault 21
R	22 31 22 00	1. Both ATS FAIL lights and VERTICAL GYRO 3 ann on. ATS DISC message in-view. Both FAST/SLOW needles out-of-view. ATS 1 (2) will operate with other channel off. 2. 22-31-00 Fig. 105 Fault 22
R	22 31 23 00	1. Both ATS FAIL lights on and F/O ADI ATT flag in-view. ATS DISC message in-view. Both FAST/SLOW needles out-of-view. ATS 1 (2) will operate with other channel off. 2. 22-31-00 Fig. 105 Fault 23
R	22 31 24 00	1. Both ATS FAIL lights and either DLC/AUTO SPLR number 1 or 2 FAIL lights on. ATS DISC, message in-view. Both FAST/SLOW needles out-of-view. ATS 1 (2) will operate with other channel off. 2. 22-31-00 Fig. 105 Fault 24

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R 22 31 25 00 R R R	1. All ATS, MACH TRIM, and MACH FEEL FAIL lights on. ATS DISC message in-view. Both FAST/SLOW needles out-of-view. ATS 1 (2) will operate with other channel off.
	2. 22-31-00 Fig. 105 Fault 25
22 31 26 00	1. Both ATS FAIL lights on and ATS DISC message in-view. Both ADI Speed flags in-view.
	2. 22-31-00 Fig. 105 Fault 26
22 31 27 00	1. All ATS, PITCH TRIM, MACH TRIM and MACH FEEL FAIL lights on. When engaged, ATS bat handle remains engaged. Both FAST/SLOW needles out-of-view.
	2. 22-31-00 Fig. 105 Fault 27
22 31 28 00	1. Both ATS FAIL lights on and ATS DISC message in-view. Both FAST/SLOW needles out-of-view.
	2. 22-31-00 Fig. 105 Fault 28
22 31 29 00	1. ATS DISC message in-view with no other fail indication.
	2. 22-31-00 Fig. 105 Fault 29
22 31 30 00	1. ATS DISC message in-view. ATS switch (bat handle) remains engaged.
	2. 22-31-00 Fig. 105 Fault 30
22 31 31 00	1. ATS upon engagement will retard (advance) throttles normally, but when ATS drives throttles in other direction, throttles disconnect.
	2. 22-31-00 Fig. 105 Fault 31
22 31 32 00	1. NOT USED.
22 31 33 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	22 31 34 00	1. NOT USED.
	22 31 35 00	1. NOT USED.
	22 31 36 00	1. NOT USED.
	22 31 37 00	1. NOT USED.
	22 31 38 00	1. NOT USED.
	22 31 39 00	1. NOT USED.
	22 31 40 00	1. NOT USED.
R R	22 31 41 00	1. Throttles do not auto stop at minimum throttle position -2 (±1) on 0-10 scale. 2. 22-31-00 Fig. 106 Fault 41
	22 31 42 00	1. Throttles do not drive to idle at touchdown. 2. 22-31-00 Fig. 106 Fault 42
	22 31 43 __	1. (01=CAPT, 02=F/O) ATS disconnect switch inoperative. 2. 22-31-00 Fig. 106 Fault 43
	22 31 44 __	1. (01=CAPT, 02=F/O) FAST/SLOW needle inoperative. 2. 22-31-00 Fig. 106 Fault 44
	22 31 45 __	1. (01=CAPT, 02=F/O) FAST/SLOW needle out-of-view. 2. 22-31-00 Fig. 106 Fault 45
	22 31 46 __	1. (01=CAPT, 02=F/O) ADI SPEED flag in-view. 2. 22-31-00 Fig. 106 Fault 46

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 31 47 00	1. ATS bat handle locked-off. No other fault indication.
	2. 22-31-00 Fig. 106 Fault 47
22 31 48 00	1. Autothrottle does not disconnect after touchdown.
	2. 22-31-00 Fig. 106 Fault 48
22 31 49 00	1. ALPHA flag in-view during airspeed mode (flaps less than 30 degrees and speed greater than 1.3 Vs).
	2. 22-31-00 Fig. 106 Fault 49
22 31 50 00	1. IAS knob (loose, rough, sticks).
	2. 22-31-00 Fig. 106 Fault 50
22 31 51 00	1. ALPHA flag out-of-view during alpha mode (flaps greater than 30 degrees or speed less than 1.3 Vs).
	2. 22-31-00 Fig. 106 Fault 51
22 31 52 00	1. Speed too high in ALPHA mode. Speed V ref +10 or V ref+20 (Should be V ref +2 to +5). No other flt sta indications.
	2. 22-31-00 Fig. 106 Fault 52
22 31 53 __	1. (01=CAPT, 02=F/O) FAST/SLOW needle erratic
	2. 22-31-00 Fig. 106 Fault 44
22 31 54 00	1. NOT USED.
22 31 55 00	1. NOT USED.
22 31 56 00	1. NOT USED.
22 31 57 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
22 31 58 00	1. NOT USED.
22 31 59 00	1. NOT USED.
22 31 60 00	1. NOT USED.
22 31 61 00	1. NOT USED.
22 31 62 00	1. NOT USED.
22 31 63 00	1. NOT USED.
22 31 64 00	1. NOT USED.
22 31 65 00	1. NOT USED.
22 31 66 00	1. NOT USED.
22 31 67 00	1. NOT USED.
22 31 68 00	1. NOT USED.
22 31 69 00	1. ATS 2 FAIL light on and ALPHA flag in view. F/O FAST/SLOW needle out-of-view. 2. 22-31-00 Fig. 104 Fault 6
22 31 70 00	1. ATS 1 FAIL light on and ALPHA flag in view. Capt FAST/SLOW needle out-of-view. 2. 22-31-00 Fig. 104 Fault 1
22 31 71 00	1. Both ATS FAIL lights on. Both FAST/SLOW needles out-of-view. 2. 22-31-00 Fig. 105 Fault 28
R 22 31 72 __ R	1. (01=CAPT, 02=F/O) AP DISC switch does not disconnect ATS. 2. 22-31-00 Fig. 103 Fault 43 22-31-00 Fig. 106 Fault 43

R EFFECTIVITY: ALL
R
050B

FAULT CODE INDEX
TABLE 1

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
R 22 31 73 __ R R	1. Throttles will not drive together (throttle lagging) (41=engine No. 1, 42=engine No. 2, 43=engine No. 3)
	2. 22-31-00 Fig. 106 (Sheet 10) Fault 53

AUTO FLIGHT - DESCRIPTION AND OPERATION

1. General

The avionic flight control system (AFCS), provides automatic operation of the aircraft flight controls over the total flight profile during climb, cruise and landing. The AFCS provides:

Fully automatic approaches and landings during low-visibility weather conditions

Yaw damping and alignment of aircraft prior to touchdown and through rollout

Direct lift control for accurate glide slope tracking and flare control

Control wheel steering for maneuvering through the autopilot system

Integrated monitoring, and status warning, to provide crew awareness of operational capability and progress

R Fail-operational capability

A. Subsystems

The AFCS consists of four subsystems:

Autopilot flight director system (22-10-00)

Yaw stability augmentation system (22-15-00)

Flight control electronics system (22-17-00)

Speed control system (22-31-00)

(1) Autopilot Flight Director System

The autopilot flight director system is an integrated system which provides autopilot and flight director functions. The autopilot provides automatic control of the aircraft in the pitch and roll axes. The flight director provides a steering command display for pitch and roll axes control.

(2) Yaw Stability Augmentation System

The yaw stability augmentation system provides yaw damping and turn coordination, during cruise, and in

the AUTOLAND mode, provides runway alignment and rollout functions.

(3) Flight Control Electronics System

The flight control electronics system provides control for the following functions:

Pitch axis electrical trim

Stall warning

Primary flight control system monitoring

Direct lift control

Altitude alert

Fault isolation monitoring displays

(4) Speed Control System

The speed control system provides automatic throttle control, and takeoff and go-around computations for the autopilot flight director system.

The AFCS subsystems provide the pilots with system performance and status information throughout the flight profile. Mode selection switches and displays are provided on the flight control panels. Two computers are provided for pitch control, two for roll and two for yaw. Separate computers are provided for pitch trim augmentation, flight control electronics, and auto throttle controls. These computers are located in the forward electronics service center, zone 112. The AFCS system utilizes sensors and servos to perform its functions.

B. System Redundancy

Redundant subsystems of the AFCS provide the following failure protection:

(1) Fail-Operational

The fail-operational status is one in which any single failure results in achieving a fail-passive status, with appropriate warning and with no degradation in autopilot performance. If a second failure occurs, the affected system may disengage and visual and aural warnings are provided to the flight crew.

(2) Fail-Passive

The fail-passive status is one in which any single failure in the sensing, computing, or servo stages causes an automatic disengagement of that system without significant changes in the aircraft flight path or control surface position.

(3) Fail-Soft

The fail-soft status is one which withstands a failure that does not endanger passenger safety and does not produce dangerous deviations in the aircraft flightpath. The occurrence of any failure affecting the fail-soft status causes disengagement of the associated automatic system or selected mode with warning.

The autopilot flight director system (APFDS) is fail-soft in the cruise configuration. The APFDS in the approach/land mode with two dual channels normally operating is fail-operational and automatically fail-passive after the first system failure. However, if only one channel (dual) is initially selected for operation, the system is fail-passive prior to the first failure.

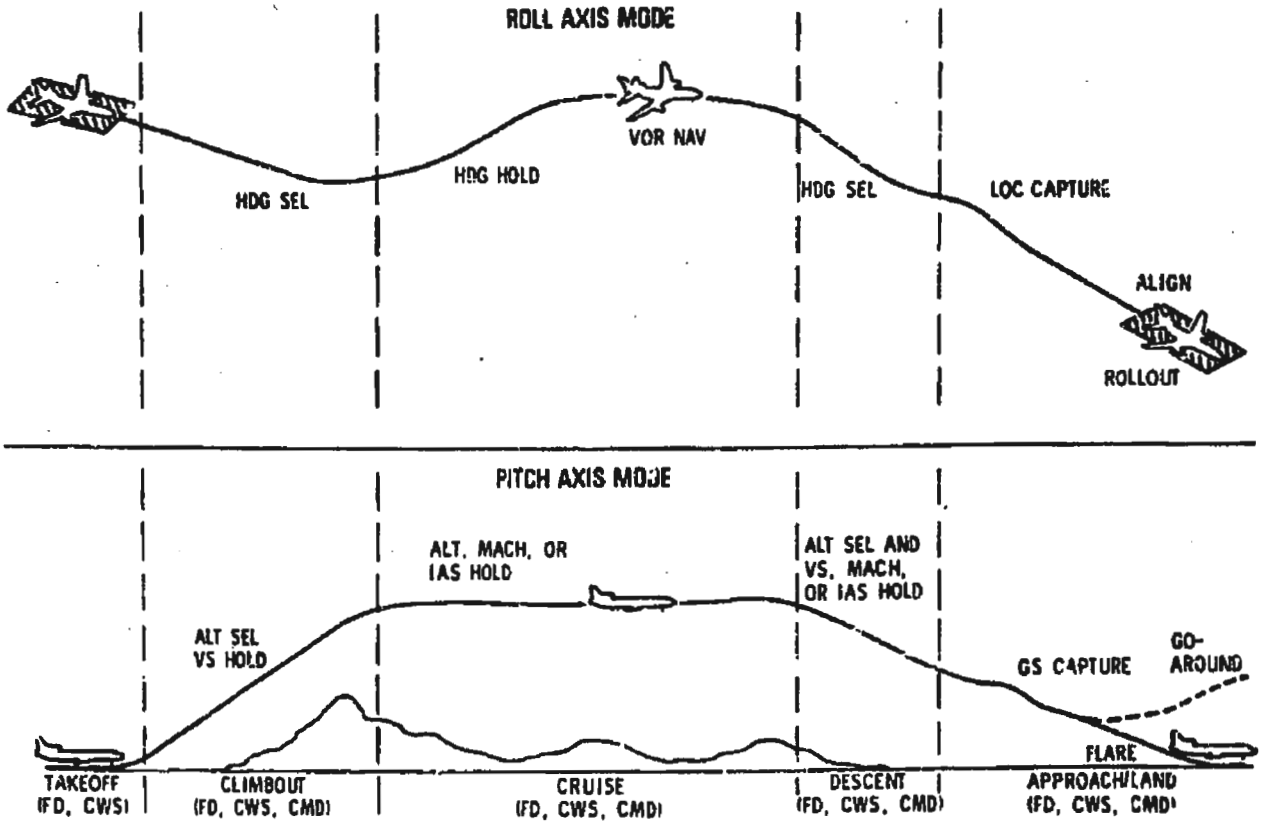
The yaw stability augmentation system, with two dual channels normally engaged is a fail-operational system and automatically becomes fail-passive after the first system failure. However, if one of the dual channels is manually disengaged, the system is a fail-passive system prior to the first failure.

The flight control electronics and speed control systems are single dual-channel systems. The system with both channels operating is a fail-passive system. However, the system is fail-soft if a single channel is initially engaged, or either channel of the system is re-engaged after disengagement as a result of the first system failure. The DLC system is fail-operational when both DLC/AGS servos are operating, except for a specific truck sensor fault that disconnects both servos, and is fail-safe when one DLC/AGS servo is operating. The AGS system is fail-safe for single channel failures when either or both channels are operating.

C. Operational Modes

The auto flight system consists of several operational modes which are selected by the pilot. Segments of the flight profile (Ref. Fig. 1) and their typical modes are as follows:

Takeoff with control wheel steering and yaw damper (operating for entire flight profile)



HH 7880
M1-0101-22-001

Auto Flight System Total Flight Profile Capability
Figure 1

Climbout with vertical speed hold, altitude select, and VOR tracking

Cruise with altitude hold, Mach hold, and VOR tracking

Descent with Mach hold, vertical speed hold, altitude select, and VOR tracking

Indicated airspeed (auto throttle control)

Localizer capture

Angle-of-attack (auto throttle control)

Glide slope capture

Runway alignment

Flare or go-around

Touchdown

Rollout

Other selectable modes available during flight are:

Attitude hold

Indicated airspeed hold

Heading select

Category I approach

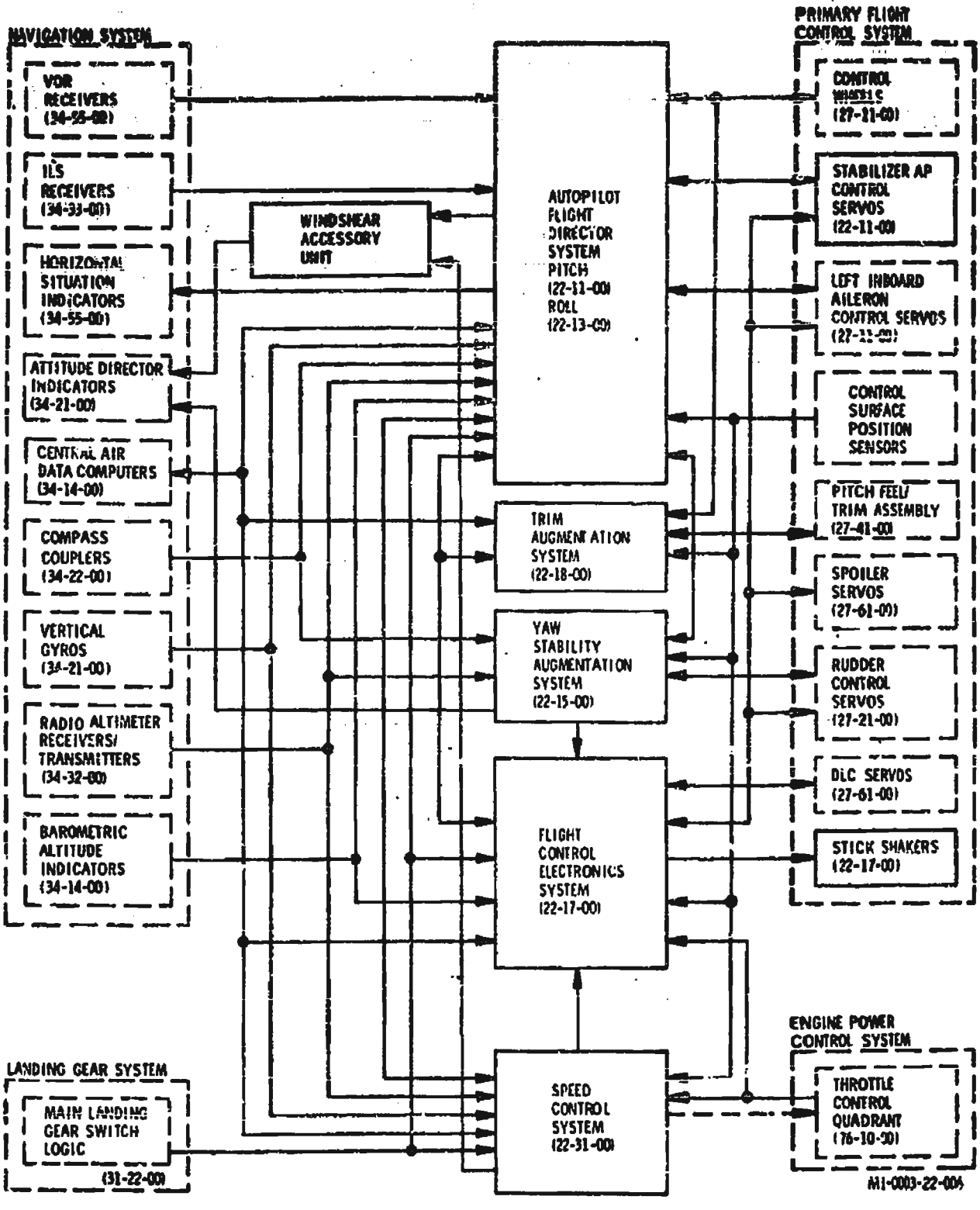
D. Interface

To provide the operational modes, the auto flight system operates in conjunction with the navigation system, the primary flight control system, and the engine power control system (Ref. Fig. 2). The following aircraft systems and components are associated with auto flight system operation, but are not a part of the system:

Air data computer system, which provides barometric altitude, Mach number, indicated and computed airspeed data, and vertical speed data

VHF navigation system for VOR tracking

Instrument landing system for localizer and glide slope capture modes


NAVIGATION SYSTEM
VOR RECEIVERS (34-55-00)
ILS RECEIVERS (34-33-00)
HORIZONTAL SITUATION INDICATORS (34-55-00)
ATTITUDE DIRECTOR INDICATORS (34-21-00)
CENTRAL AIR DATA COMPUTERS (34-14-00)
COMPASS COUPLERS (34-22-00)
VERTICAL GYROS (34-21-00)
RADIO ALTIMETER RECEIVERS/ TRANSMITTERS (34-32-00)
BAROMETRIC ALTITUDE INDICATORS (34-14-00)
WINDSHEAR ACCESSORY UNIT
AUTOPILOT FLIGHT DIRECTOR SYSTEM PITCH (22-11-00) ROLL (22-13-00)
TRIM AUGMENTATION SYSTEM (22-18-00)
YAW STABILITY AUGMENTATION SYSTEM (22-15-00)
FLIGHT CONTROL ELECTRONICS SYSTEM (22-17-00)
SPEED CONTROL SYSTEM (22-31-00)
LANDING GEAR SYSTEM
MAIN LANDING GEAR SWITCH LOGIC (31-22-00)
PRIMARY FLIGHT CONTROL SYSTEM
CONTROL WHEEL S (27-11-00)
STABILIZER AP CONTROL SERVOS (22-11-00)
LEFT INBOARD AILERON CONTROL SERVOS (27-11-00)
CONTROL SURFACE POSITION SENSORS
PITCH FEEL/ TRIM ASSEMBLY (27-41-00)
SPOILER SERVOS (27-61-00)
RUDDER CONTROL SERVOS (27-21-00)
DLC SERVOS (27-61-00)
STICK SHAKERS (22-17-00)
ENGINE POWER CONTROL SYSTEM
THROTTLE CONTROL QUADRANT (76-10-00)
M1-0003-22-004

R Auto Flight System Interface Block Diagram
R Figure 2

EFFECTIVITY: WITH SB34-178

Magnetic heading reference system, which provides heading reference

Radio altimeter system, which provides radio altitude information

Attitude reference vertical gyros which provide pitch and roll attitude data

Attitude director and horizontal situation indicators display flight director and flightpath data

Primary flight control system for which the auto flight system provides automatic control and monitoring

Engine power control system for auto throttle operation

Aircraft electrical system, which provides auto flight system operating power

Air-ground sensing system, which provides weight-on-wheels and truck tilt discrete logic signals

R # AUTO FLIGHT - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting Auto Flight System faults are included in this section of the manual. An Auto Flight System malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point contains the fault isolation procedure. When no fault number is specified, use Auto Flight System FIM or fault matrix.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Using FIM

R A. Introduction

R The L-1011 Avionics Flight Control System (AFCS) is equipped with a Fault Isolation Monitoring (FIM) system which identifies faults within the AFCS to the Line Replaceable Unit (LRU), or to the system level for associated input systems. Instructions provided by Table 101 enable the avionics technician to quickly diagnose and accurately correct an AFCS fault. This is accomplished utilizing the FIM indicator or indicators located on the front panel of each AFCS computer in conjunction with any information provided by the flight squawk.

R FIM is continuously monitoring the AFCS while in-flight under actual environmental and operational conditions. This enables FIM to not only detect and indicate static faults, but to also detect and indicate dynamic faults which cannot be duplicated by maintenance personnel on the ground. Thus, FIM minimizes the need for on-board test equipment and bulky/lengthy trouble-shooting procedures in the maintenance manual.

R B. Format

R Table 101 contains three types of information:

R (1) FIM ball of concern.

R (2) Observations; for instance, if the ATTITUDE GYROS FIM ball is tripped, it could be due to any one of three V.G.'s. Information contained in the flight squawk may key as to which V.G. it is.

R (3) Corrective action.

R C. How To Use

R Flight squawks are almost always identified by system. Leading particulars may or may not be provided.

R Assuming a flight squawk against the AFCS, scan the AFCS computers for FIM balls and note which ones are displayed. Locate, in the left hand column of Table 101, the FIM ball(s) of interest. In the observation column adjacent to the FIM ball, of interest, relate to flight squawk for leading particulars, such as which channel of APFDS, TRIM, etc., and perform indicated corrective action.

R It is recognized that certain flight squawks may occur, but for which, there is no attendant FIM ball triggered on the AFCS computers. In these cases, it is assumed that maintenance personnel will utilize fault isolation procedures that are provided elsewhere in the Maintenance Manual (See Table 102).

R In those instances in which a FIM ball indicates only one line replaceable unit (such as normal accelerometer), the corrective action is self-evident and no observation data has been suggested.

R Auto Flight System Fault Isolation Using FIM
R Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
NOTE: On aircraft with roll computers modified by Collins SB38, HDG INPUTS system FIM circuits are defeated.		
HDG INPUTS	1. Squawk is associated with APFDS channel A.	Replace Compass Coupler No. 1 (Ref. 34-22-03).
	2. Squawk is associated with APFDS channel B.	Replace Compass Coupler No. 2 (Ref. 34-22-03).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
	3. Squawk is associated with the Preselected Hdg Bug on the HSIs.	Replace HDG/PITCH MODE panel (Ref. 22-10-03).
AIR DATA INPUTS	1. Squawk is associated with APFDS channel A, or Mach Trim/Mach Feel channel No. 1, or speed control channel No. 1.	Replace CADC No. 1 (Ref. 34-14-01).
	2. Squawk is associated with APFDS channel B, or Mach Trim/Mach Feel channel No. 2, or speed control channel No. 2.	Replace CADC No. 2 (Ref. 34-14-01).
ATTITUDE GYROS	1. Squawk is associated with APFDS channel A.	On aircraft 001-024 and 027, replace Vertical Gyro No. 1 (Ref. 34-21-04). On aircraft 025, 026, 028 thru 999, replace Inertial Unit No. 1 (Ref. 34-43-03)
	2. Squawk is associated with APFDS channel B.	On aircraft 001-024 and 027, replace Vertical Gyro No. 2 (Ref. 34-21-04). On aircraft 025, 026, 028 thru 999, replace Inertial Unit No. 2 (Ref. 34-43-03)
	3. Squawk is associated with both APFDS channels.	On aircraft 001 thru 024, 027, replace Vertical Gyro No. 3 (Ref. 34-21-04). On aircraft 025, 026, 028 thru 999, replace Inertial Unit No. 3 (Ref. 34-43-01)
ANGLE OF ATTACK 1		Replace Left Angle of Attack Sensor (Ref. 22-31-06).
ANGLE OF ATTACK 2		Replace Right Angle of Attack Sensor (Ref. 22-31-06).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
YAW RATE GYRO 1		Replace Yaw Rate Gyro No. 1 (Ref. 22-15-02).
YAW RATE GYRO 2		Replace Yaw Rate Gyro No. 2 (Ref. 22-15-02).
YAW RATE GYRO 3		Replace Yaw Rate Gyro No. 3 (Ref. 22-15-02).
LATERAL ACCEL.		Replace Lateral Accelerometer (Ref. 22-13-02).
LONG. ACCEL.		Replace Longitudinal Accelerometer (Ref. 22-31-05).
NORMAL ACCEL.		Replace Normal Accelerometer (Ref. 22-11-02).
PITCH A/P SERVO 1		Replace any one of the following sub-assemblies on the Stabilizer Autopilot Control Servo. After replacement, retest system to determine if flight squawk has been cleared. (1) Hydraulic System B Pressurizing Solenoid Shutoff Valve (Ref. 22-11-07). (2) Hydraulic System B Engage Solenoid Shutoff Valve (Ref. 22-11-07). (3) Hydraulic System B High Level Override Solenoid Shutoff Valve (Ref. 22-11-07).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
		(4) Hydraulic System B Engage and Override Warning Pressure Switch (Ref. 22-11-09). (5) Hydraulic System B High Level Override Force Pressure Switch (Ref. 22-11-09). (6) Hydraulic System B EHV (Avionic Sys. No. 1), (Ref. 22-11-08). If the above actions did not result in clearing the flight squawk, replace the Stabilizer Autopilot Control Servo (Ref. 22-11-05).
PITCH A/P SERVO 2		Same as above for Pitch A/P Servo 1 FIM ball, except Avionics Systems No. 2 and Hydraulic Systems A.
ROLL A/P SERVO 1		Replace any one of the following sub-assemblies on the Left Inboard Aileron Servo. After replacement, retest system to determine if flight squawk has been cleared. (1) Pressure Switch, Avionics System No. 1, Hydraulic System B (Ref. 27-11-37). (2) Solenoid Shutoff Valve, Avionic System No. 1, Hydraulic System B (Ref. 27-11-20).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
		(3) Electrohydraulic Servo Valve, Avionic System No. 1, Hydraulic System B (Ref. 27-11-21). If the above actions did not result in clearing the flight squawk, replace the Left Inboard Aileron Servo (Ref. 27-11-17).
ROLL A/P SERVO 2		Same as for Roll A/P Servo 1, except for Avionics System No. 2 and Hydraulic System A.
YAW SAS SERVO 1		Replace any one of the following sub-assemblies on the Rudder Servo Module. After replacement, retest system to determine if flight squawk has been cleared. (1) SAS Solenoid Shutoff Valve, Hydraulic System B (Ref. 27-21-08). (2) Autopilot Engage Solenoid Shutoff Valve, Avionic System No. 1, Hydraulic System B (Ref. 27-21-08). (3) Pressure Switch, Hydraulic System B, Avionic System No. 1 (Ref. 27-21-24). (4) Electrohydraulic Servo Valve, Hydraulic System B, Avionic System No. 1 (Ref. 27-21-09).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
		If the above actions did not result in clearing the flight squawk, replace the Rudder Servo Module (Ref. 27-21-07).
YAW SAS SERVO 2	If Rudder Fusing System Tripped, do not proceed with the corrective action indicated herein.	Same as for Yaw SAS Servo 1, except for Avionics System No. 2 and Hydraulic System A.
ROLL COMP 1 OR 2	1. Squawk is associated with APFDS channel A.	Replace Roll Computer No. 1 (Ref. 22-13-01).
	2. Squawk is associated with APFDS channel B.	Replace Roll Computer No. 2 (Ref. 22-13-01).
	3. Squawk is not associated with any one channel of APFDS.	Replace both Roll Computers (Ref. 22-13-01).
PITCH COMP 1 OR 2	1. Squawk is associated with APFDS channel A.	Replace Pitch Computer No. 1 (Ref. 22-11-01).
	2. Squawk is associated with APFDS channel B.	Replace Pitch Computer No. 2 (Ref. 22-11-01).
	3. Squawk is not associated with any one channel of APFDS.	Replace both Pitch Computers (Ref. 22-11-01).
CONTROL WHEEL 1		Replace Capt Control Wheel (Ref. 27-11-01).
CONTROL WHEEL 2		Replace F/O Control Wheel (Ref. 27-11-01).
DLC SERVO 1		Replace any one of the following sub-assemblies on the Direct Lift Control Servo. After replacement retest system to determine if flight squawk has been cleared.

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
		(1) Solenoid Valve 1, DLC Mode, Hydraulic System B, Avionic Channel 1 (Ref. 27-61-08). (2) Solenoid Valve 2, DLC Mode, Hydraulic System B, Avionic Channel 1 (Ref. 27-61-08). (3) Solenoid Valve 3, Stroke Limiter, Hydraulic System B, Avionic Channel 1 (Ref. 27-61-08). (4) Pressure Switch No. 2, DLC Mode, Hydraulic System B (Ref. 27-61-36). (5) Electrohydraulic Servo Valve, Avionic Channel No. 1, Hydraulic System B (Ref. 27-61-07). If the above actions did not result in clearing the flight squawk, replace the Direct Lift Control Servo (Ref. 27-61-06).
DLC SERVO 2		Replace any one of the following sub-assemblies on the Direct Lift Control Servo. After replacement, retest system to determine if flight squawk has been cleared. (1) Solenoid Valve 4, DLC Mode, Hydraulic System A, Avionic Channel 2 (Ref. 27-61-08).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
		(2) Solenoid Valve 5, Stroke Limiter, Hydraulic System A, Avionic Channel 2 (Ref. 27-61-08). (3) Pressure Switch No. 4, DLC Mode, Hydraulic System A (Ref. 27-61-36). (4) Electrohydraulic Servo Valve, Avionic Channel No. 2, Hydraulic System A (Ref. 27-61-07). If the above actions did not result in clearing the flight squawk, replace the Direct Lift Control Servo (Ref. 27-61-06).
AUTO THT SERVO		Replace Auto Throttle Servo (Ref. 22-31-01).
ELEC. FEEL & TRIM MECH		On Electrical Pitch Feel/Trim Assembly, replace the indicated sub-assembly below for the appropriate observation. After replacement, retest system to determine if flight squawk has been cleared.
	(1) Fault is associated with Pitch Trim Channel No. 1.	(1) Electrical Trim Motor No. 1 (Ref. 22-18-10).
	(1) Fault is associated with Pitch Trim Channel No. 2.	(2) Electrical Trim Motor No. 2 (Ref. 22-18-10).
	(3) Fault is associated with Mach Trim Channel No. 1.	(3) Mach Trim Motor No. 1 (Ref. 22-21-01).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
	(4) Fault is associated with Mach Trim Channel No. 2.	(4) Mach Trim Motor No. 2 (Ref. 22-21-01).
	(5) Fault is associated with Mach Feel Channel No. 1.	(5) Mach Feel Schedule Motor No. 1 (Ref. 22-21-02).
	(6) Fault is associated with Mach Feel Channel No. 2.	(6) Mach Feel Schedule Motor No. 2 (Ref. 22-21-02).
		If the above actions did not result in clearing the flight squawk, replace the Electrical Pitch Feel/Trim Assembly (Ref. 27-41-16).
DLC SWITCHES	Perform BITE Check on Proximity Logic Box and Card Box.	
	1. BITE checks indicate faulty card(s).	1. Replace faulty card (Ref. 33-17-04).
	2. No Faulty cards indicated.	2. Replace AFCS/MLG Accessory Unit (Ref. 22-10-11).
FCES COMPUTER FAULT		Replace FCES Computer (Ref. 22-17-01).
SPEED COMPUTER FAULT		Replace Speed Computer (Ref. 22-31-07).
TRIM AUG COMPUTER FAULT		Replace Trim Aug Computer (Ref. 22-18-01).
YAW COMP. NO. 1, COMPUTER FAULT		Replace Yaw Computer No. 1 (Ref. 22-15-01).

Auto Flight System Fault Isolation Using FIM (Cont)
Table 101

FIM BALL	OBSERVATIONS	CORRECTIVE ACTION
YAW COMP. NO. 2, COMPUTER FAULT		Replace Yaw Computer No. 2 (Ref. 22-15-01).
ROLL COMP. NO. 1, COMPUTER FAULT		Replace Roll Computer No. 1 (Ref. 22-13-01).
ROLL COMP. NO. 2, COMPUTER FAULT		Replace Roll Computer No. 2 (Ref. 22-13-01).
PITCH COMP. NO. 1, COMPUTER FAULT		Replace Pitch Computer No. 1 (Ref. 22-11-01).
PITCH COMP. NO. 2, COMPUTER FAULT		Replace Pitch Computer No. 2 (Ref. 22-11-01).

SYSTEM FAULT	FAULT ISOLATION	PAGE
AUTO FLIGHT SYSTEM	22-00-00	101
AFCS MODES OF OPERATION (AUTOPILOT – FLIGHT DIRECTOR PITCH & ROLL)		
AFCS/MLG ACCESSORY UNIT	22-10-11	101
AFCS LAMPS AND ANNUNCIATORS	22-02-01	101
AFDS MODES		
FD BASIC MODE	22-10-31	101
FD IAS HOLD MODE	22-11-37	101
FD MACH HOLD MODE	22-11-39	101
FD ALTITUDE HOLD MODE	22-11-33	101
FD VERTICAL SPEED MODE	22-11-31	101
FD ALTITUDE SELECT MODE	22-11-35	101
FD HEADING SELECT MODE	22-13-31	101
FD NAV (VOR) MODE	22-13-35	101
FD LOCALIZER MODE	22-12-19	101
FD APPROACH MODE	22-12-21	101
AUTOPILOT A CWS/CMD MODE	22-10-33	101
AUTOPILOT B CWS/CMD MODE	22-10-35	101
TURBULENCE MODE	22-11-43	101
TAKEOFF MODE	22-12-29	101
AUTOLAND MODE (TOTAL SEQUENCE)	22-14-31	101
AUTOLAND MODE (PRE-TRACK AND TRACK)	22-14-33	101
AUTOLAND TRACK MODE (ALIGN, FLARE AND ROLL OUT)	22-14-35	101
DUAL A/L NOT AVAIL (DANA)	22-12-37	101
GO-AROUND MODE	22-12-39	101
YAW SAS SYSTEM	22-15-00	101
FCES SYSTEMS		
STALL WARNING SYSTEM	22-17-05	101
ALTITUDE ALERT SYSTEM	22-17-06	101
DIRECT LIFT CONTROL/AUTOMATIC GROUND SPOILER (DLC/AGS)	22-17-07	101
PITCH TRIM SYSTEM	22-18-00	101
MACH TRIM SYSTEM	22-21-00	101
MACH FEEL SYSTEM	22-21-00	101
SPEED CONTROL SYSTEM	22-31-00	101

M1-0004-22-266

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AFCS Fault Isolation Breakdown
Table 102

EFFECTIVITY: ALL

001B

3. Fault Isolation/Identification

A. General

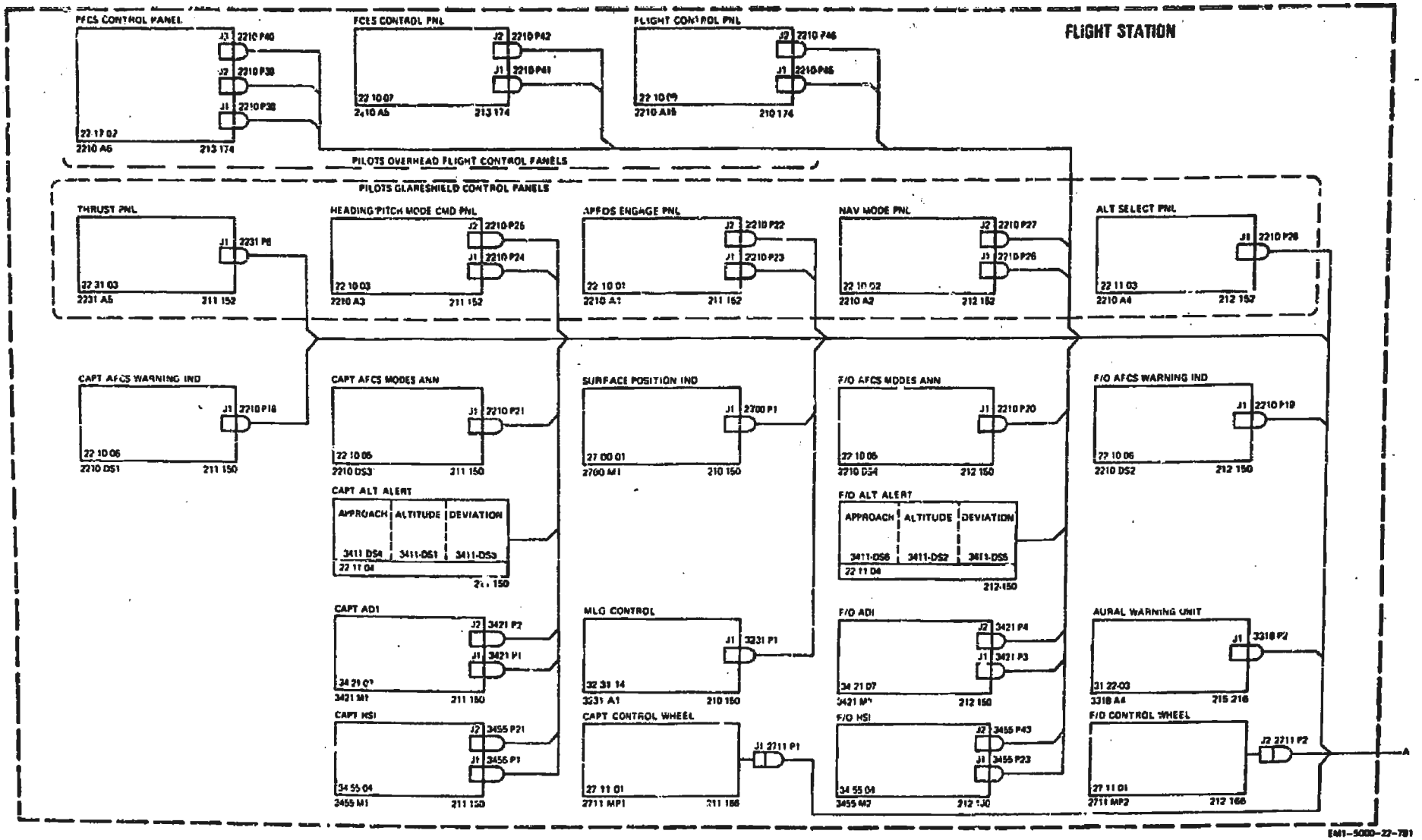
Table 102 is a breakdown of AFCS fault isolation procedures by ATA number. Table 103 lists general AFCS fault isolation diagrams and schematics.

B. FIRM

On receipt of a Chapter 22 FIRM fault code, refer to the 22-INDEX. This index provides two pieces of information relating to each FIRM fault code. The first is a duplicate of the flight report that the flight crew has entered in the aircraft log book. The second bit of information is the reference to the fault isolation procedure where corrective
R action is provided.

Auto Flight System Fault Isolation Diagram
Table 103

SCHEM NO.	TITLE
1	AFCS Interconnect Cabling Block Diagram
2	AFCS Primary Power Distribution, Pilots Overhead CB Panel, CB1 Schematic
3	AFCS Primary Power Distribution, FE/SO Overhead CB Panel, CB2 and Aft CB Panel CB3 Schematic
4	AFCS Control Panel Lamp Test and Dimming Schematic
5	AFCS Schematic Home Diagram
6	APFDS Schematic Symbols Not Covered by ATA 100
7	Flight Controls Hydraulic Power Distribution Schematic.
8	Captains Control Wheel Schematic
9	First Officers Control Wheel Schematic
10	AFCS Mode Compatibility Matrix



EMI-5000-22-781

R AFCS Interconnect Cabling Block Diagram
R SCHEM 1 (Sheet 1)

EFFECTIVITY: ALL

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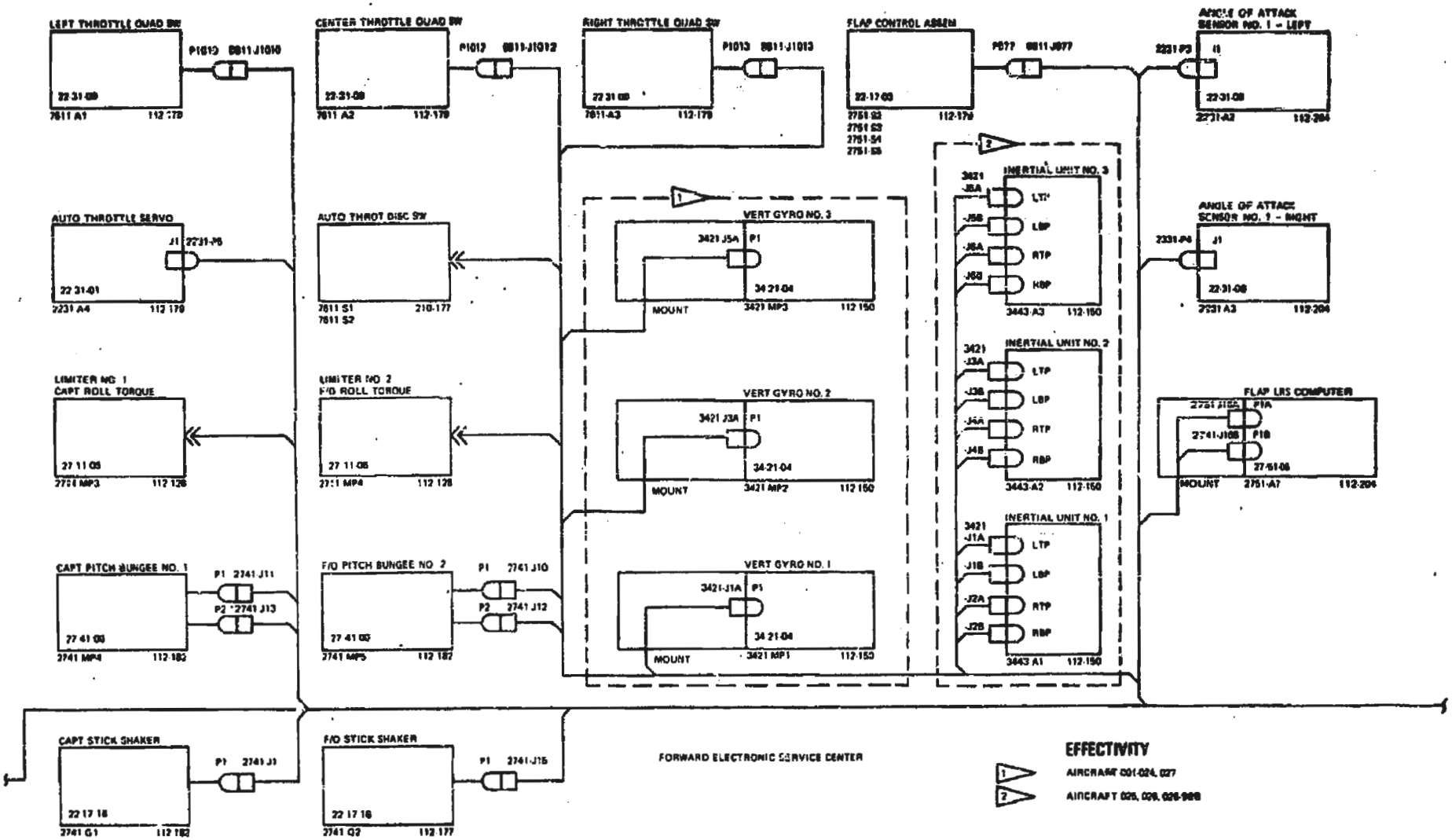
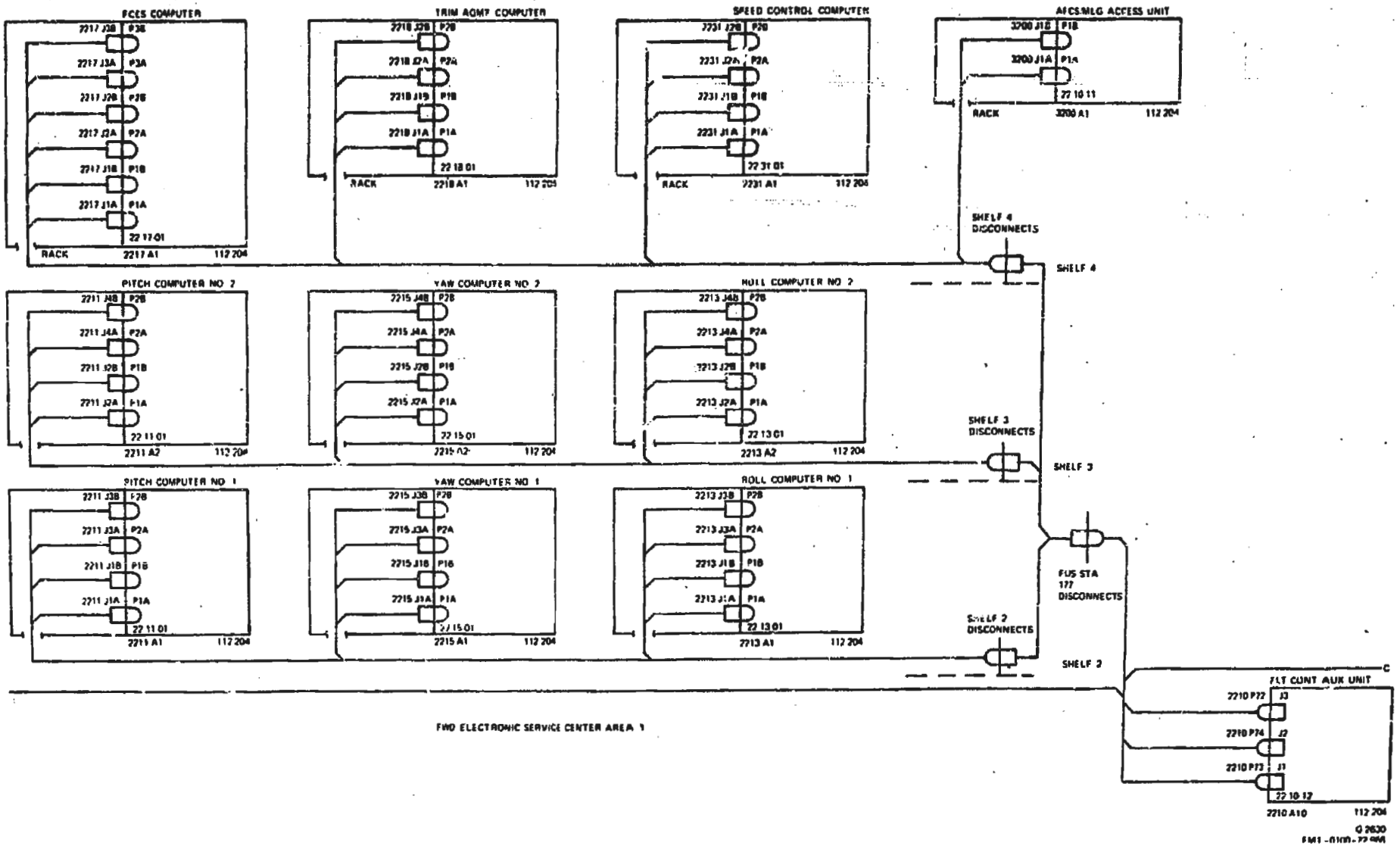

LEFT THROTTLE QUAD SW
CENTER THROTTLE QUAD SW
RIGHT THROTTLE QUAD SW
FLAP CONTROL ASSEM
ANGLE OF ATTACK SENSOR NO. 1 - LEFT
AUTO THROTTLE SERVO
AUTO THROT DISC SW
VERT GYRO NO. 3
VERT GYRO NO. 2
VERT GYRO NO. 1
INERTIAL UNIT NO. 3
INERTIAL UNIT NO. 2
INERTIAL UNIT NO. 1
ANGLE OF ATTACK SENSOR NO. 2 - RIGHT
LIMITER NO. 1 CAPT ROLL TORQUE
LIMITER NO. 2 F/O ROLL TORQUE
FLAP LRS COMPUTER
CAPT PITCH BUNGEE NO. 1
F/O PITCH BUNGEE NO. 2
CAPT STICK SHAKER
F/O STICK SHAKER
FORWARD ELECTRONIC SERVICE CENTER
EFFECTIVITY
AIRCRAFT 001-024, 027
AIRCRAFT 025, 026, 028-999

R AFCS Interconnect Cabling Block Diagram
R SCHEM 1 (Sheet 2)

EFFECTIVITY: ALL

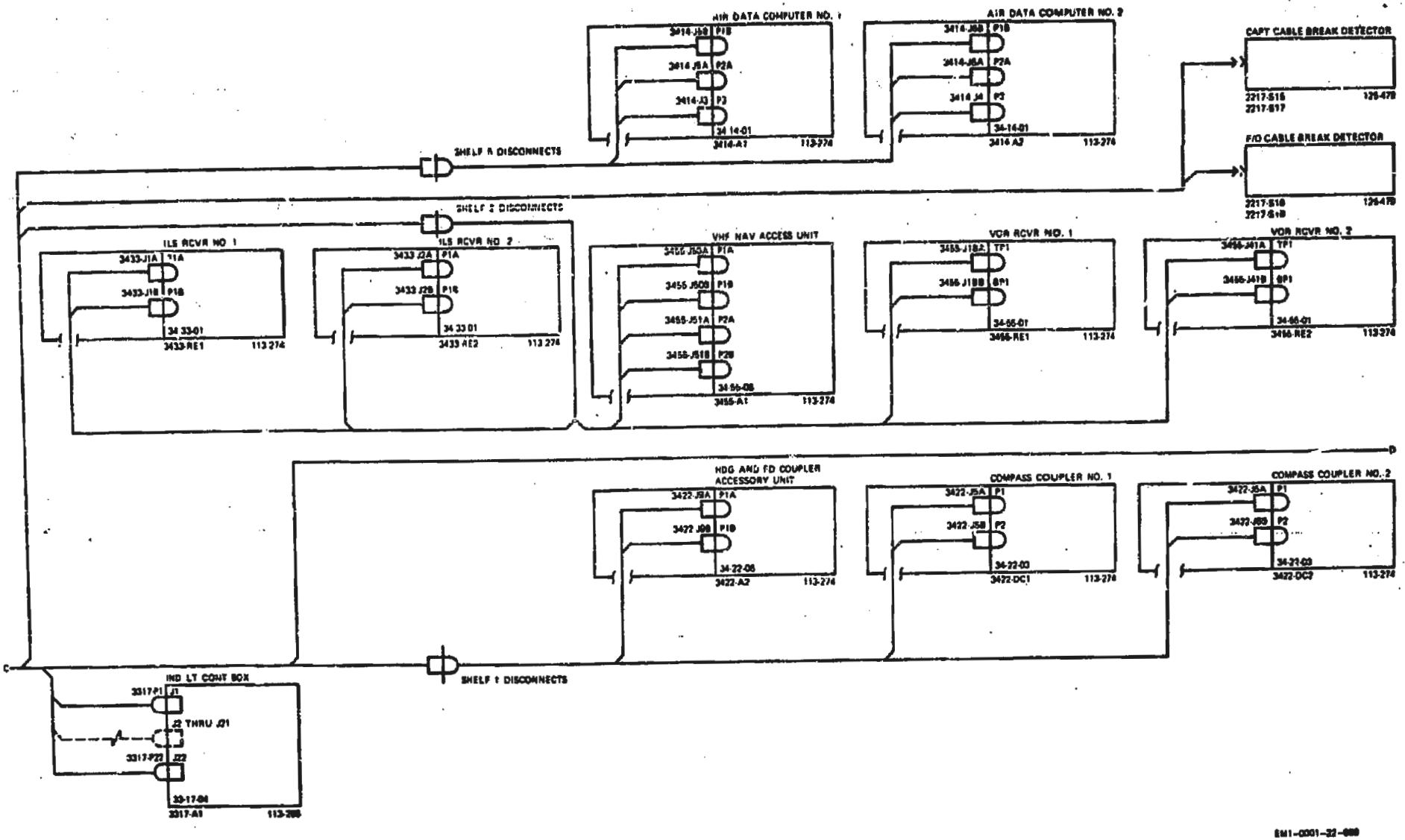
001B



R AFCS Interconnect Cabling Block Diagram
R SCHEM 1 (Sheet 3)

EFFECTIVITY: ALL

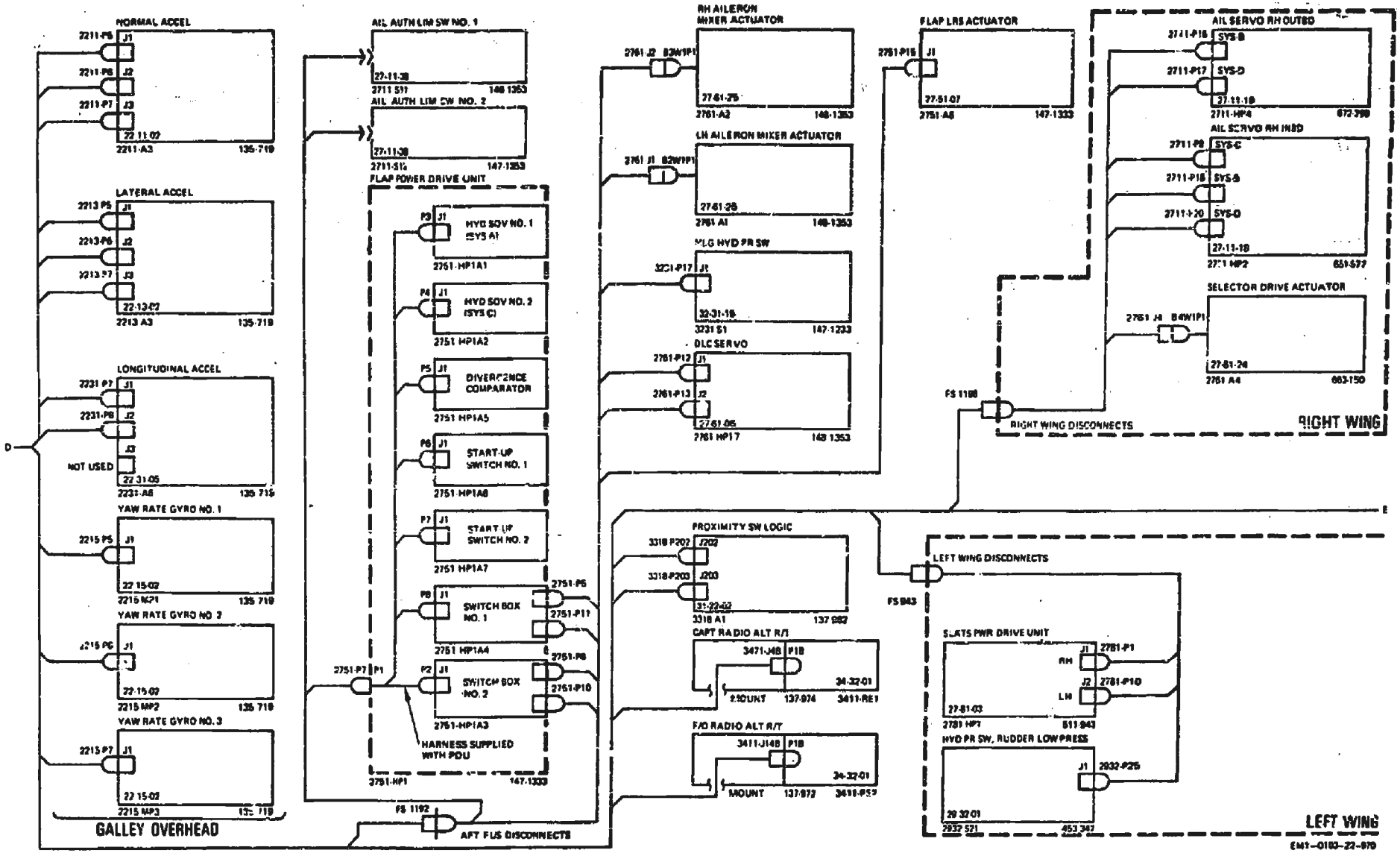
001B


AIR DATA COMPUTER NO. 1
AIR DATA COMPUTER NO. 2
CAPT CABLE BREAK DETECTOR
F/O CABLE BREAK DETECTOR
SHELF A DISCONNECTS
SHELF 2 DISCONNECTS
ILS RCVR NO. 1
ILS RCVR NO. 2
VHF NAV ACCESS UNIT
VOR RCVR NO. 1
VOR RCVR NO. 2
HDG AND FD COUPLER ACCESSORY UNIT
COMPASS COUPLER NO. 1
COMPASS COUPLER NO. 2
SHELF 1 DISCONNECTS
IND LT CONT BOX
J2 THRU J21

R AFCS Interconnect Cabling Block Diagram
R SCHEM 1 (Sheet 4)

EFFECTIVITY: ALL

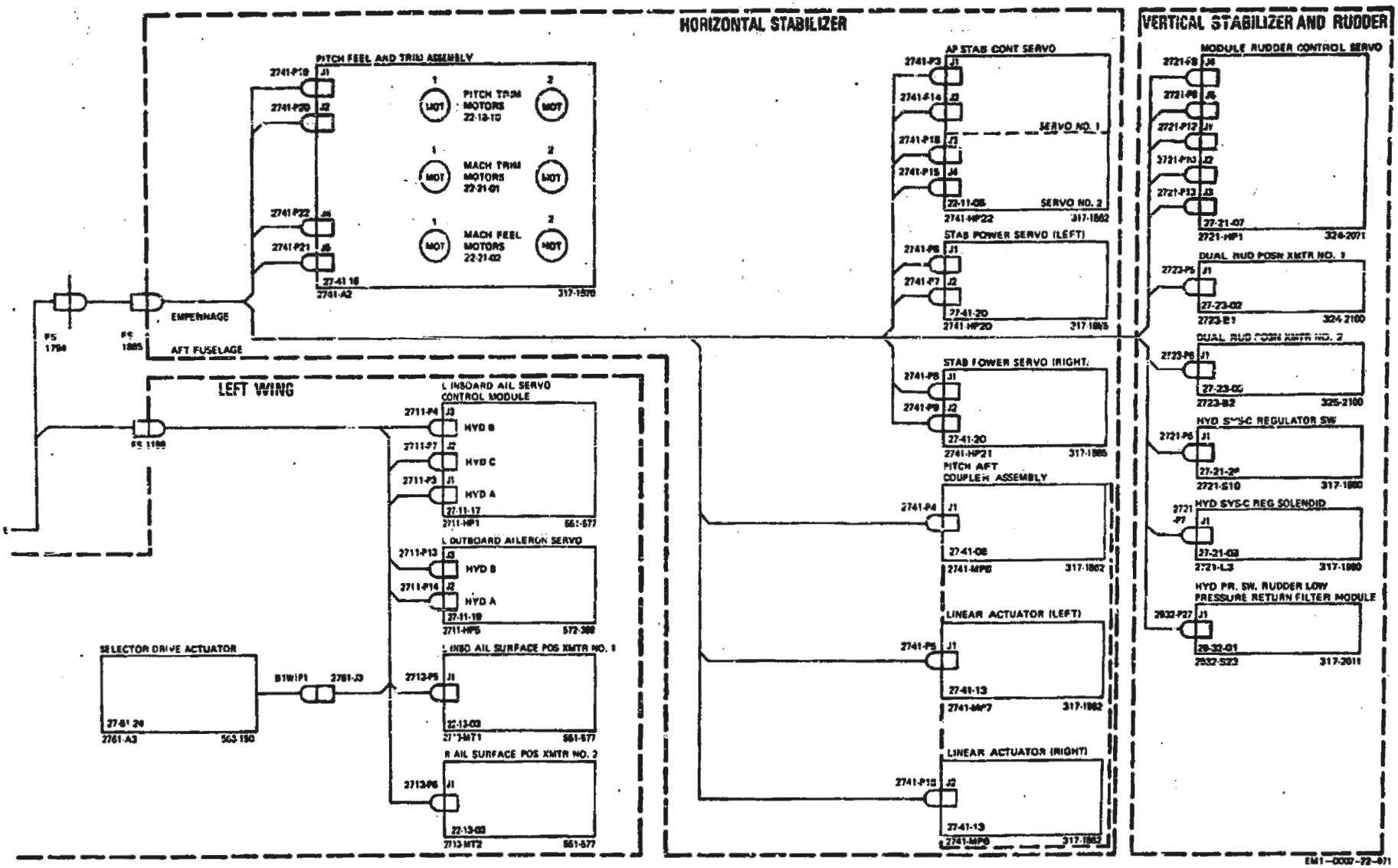
001B



R AFCS Interconnect Cabling Block Diagram
R SCHEM 1 (Sheet 5)

EFFECTIVITY: ALL

001B

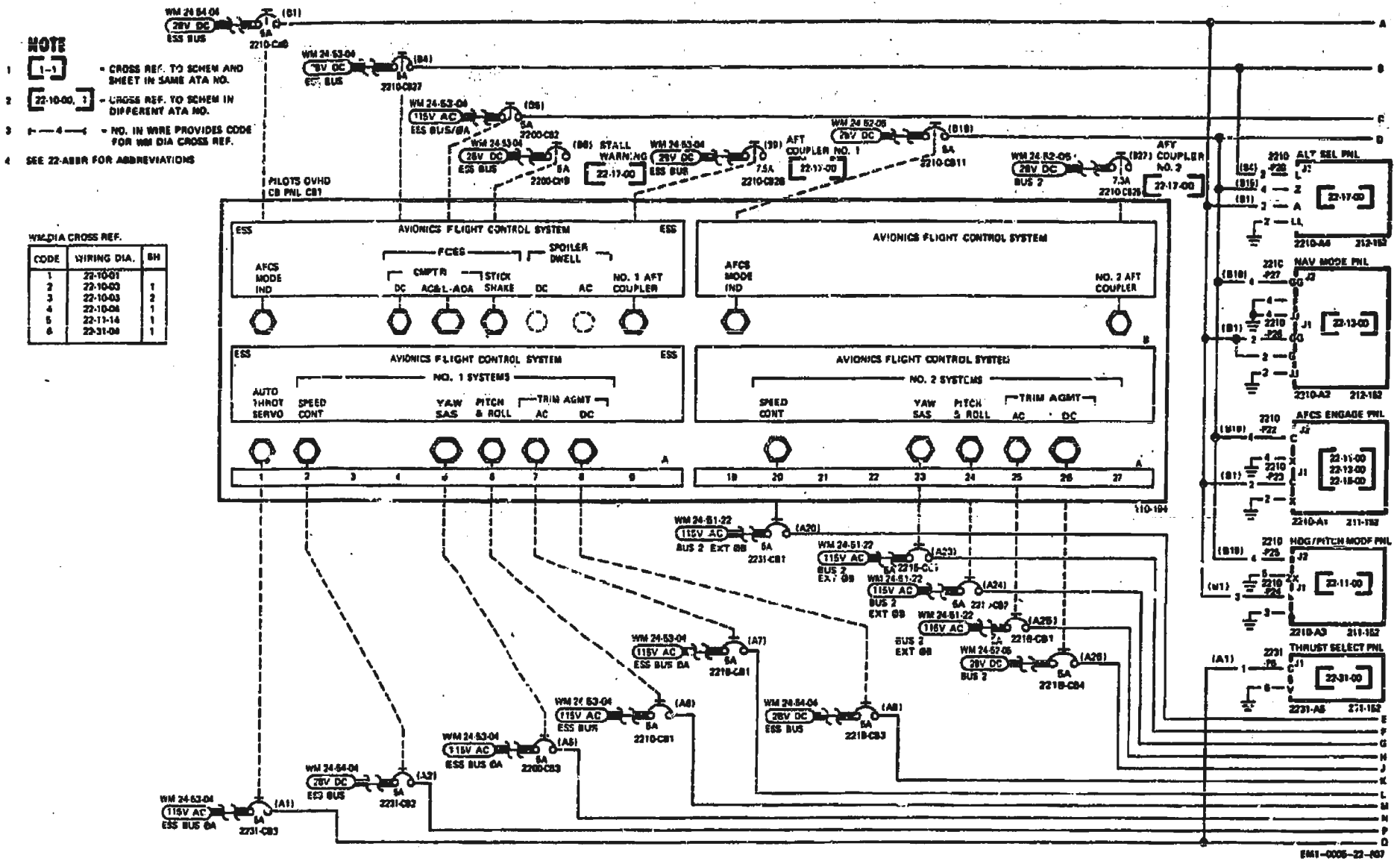

HORIZONTAL STABILIZER
VERTICAL STABILIZER AND RUDDER
PITCH FEEL AND TRIM ASSEMBLY
PITCH TRIM MOTORS
MACH TRIM MOTORS
MACH FEEL MOTORS
EMPENNAGE
AFT FUSELAGE
LEFT WING
AP STAB CONT SERVO
SERVO NO. 1
SERVO NO. 2
STAB POWER SERVO (LEFT)
STAB POWER SERVO (RIGHT)
PITCH AFT COUPLER ASSEMBLY
LINEAR ACTUATOR (LEFT)
LINEAR ACTUATOR (RIGHT)
L INBOARD AIL SERVO CONTROL MODULE
L OUTBOARD AILERON SERVO
SELECTOR DRIVE ACTUATOR
L INBD AIL SURFACE POS XMTR NO. 1
R AIL SURFACE POS XMTR NO. 2
MODULE RUDDER CONTROL SERVO
DUAL RUD POSN XMTR NO. 1
DUAL RUD POSN XMTR NO. 2
HYD SYS-C REGULATOR SW
HYD SYS-C REG SOLENOID
HYD PR. SW. RUDDER LOW PRESSURE RETURN FILTER MODULE

AFCS Interconnect Cabling Block Diagram
SCHEM 1 (Sheet 6)

R
R

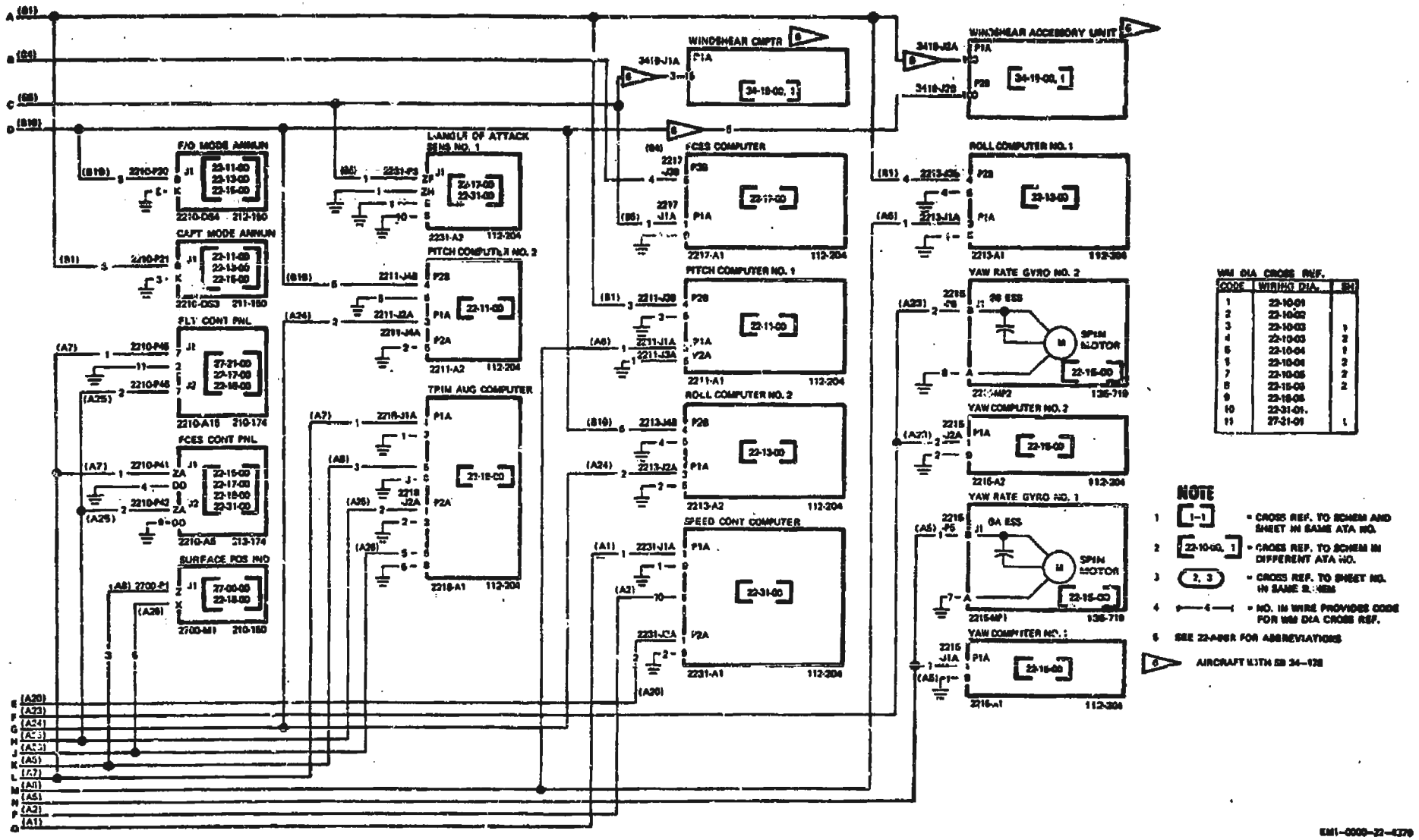
EFFECTIVITY: ALL

0018


NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 1 — 4 — 4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-10-01 |
2 | 22-10-02 | 1
3 | 22-10-03 | 2
4 | 22-10-04 | 1
5 | 22-11-14 | 1
6 | 22-31-04 | 1
PILOTS OVHD CB PNL CB1
AVIONICS FLIGHT CONTROL SYSTEM
AFCS MODE IND
FCES
CMPTR
STICK SHAKE
SPOILER DWELL
NO. 1 AFT COUPLER
NO. 2 AFT COUPLER
NO. 1 SYSTEMS
NO. 2 SYSTEMS
AUTO THROT SERVO
SPEED CONT
YAW SAS
PITCH & ROLL
TRIM AGMT
STALL WARNING
AFT COUPLER NO. 1
AFT COUPLER NO. 2
ALT SEL PNL
NAV MODE PNL
AFCS ENGAGE PNL
HDG/PITCH MODE PNL
THRUST SELECT PNL
ESS BUS
BUS 2
ESS BUS 6A
BUS 2 EXT 6B

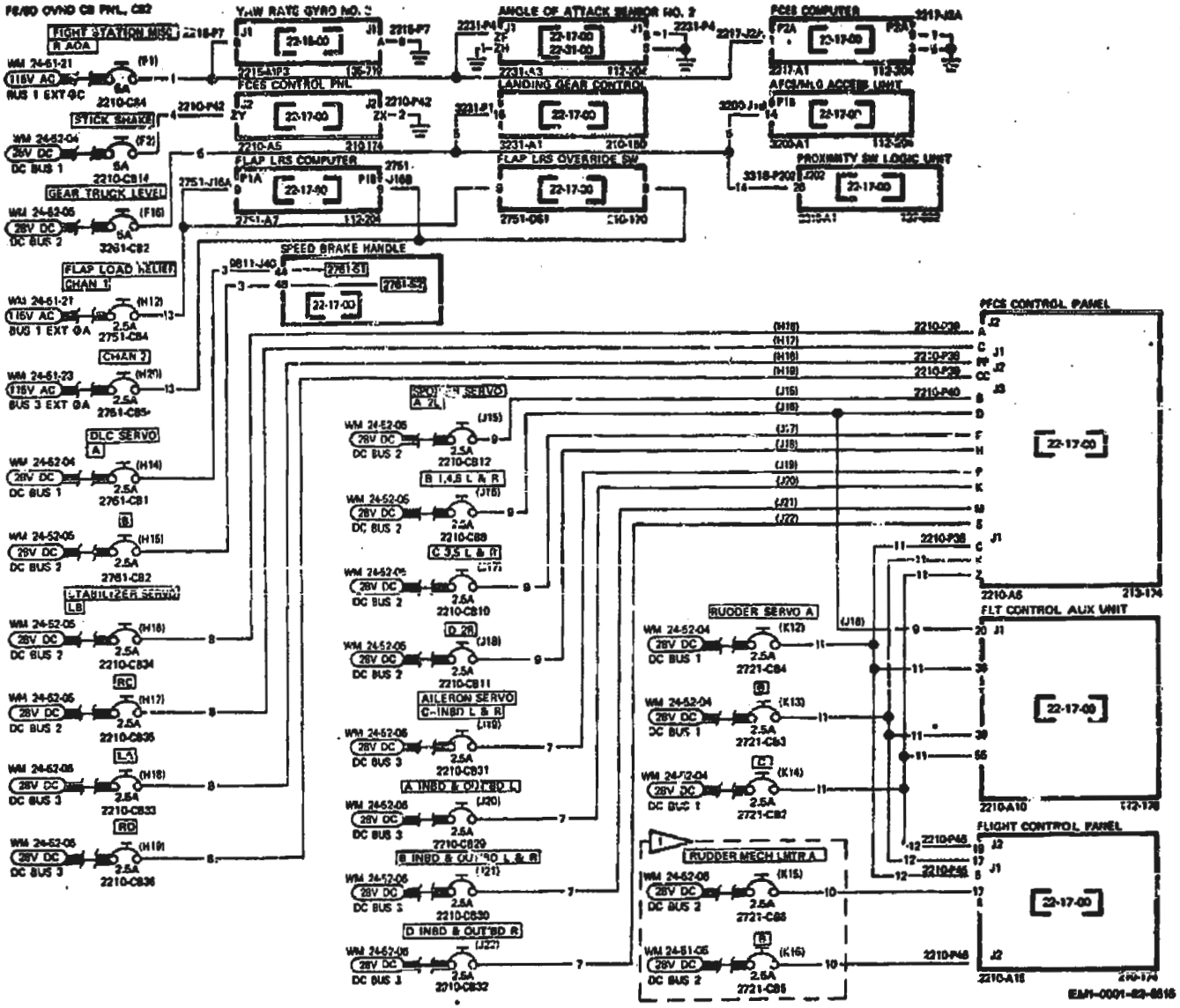
R AFCS Primary Power Distribution, Pilots Overhead CB Panel,
R CB1 Schematic
R SCHEM 2 (Sheet 1)

EFFECTIVITY: ALL



R AFCS Primary Power Distribution, Pilots Overhead CB Panel,
R CB1 Schematic
R SCHEM 2 (Sheet 2)

EFFECTIVITY: ALL



NOTE

1. [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5. SEE 22-ABBR FOR ABBREVIATIONS
6. 1 AIRCRAFT 301-917

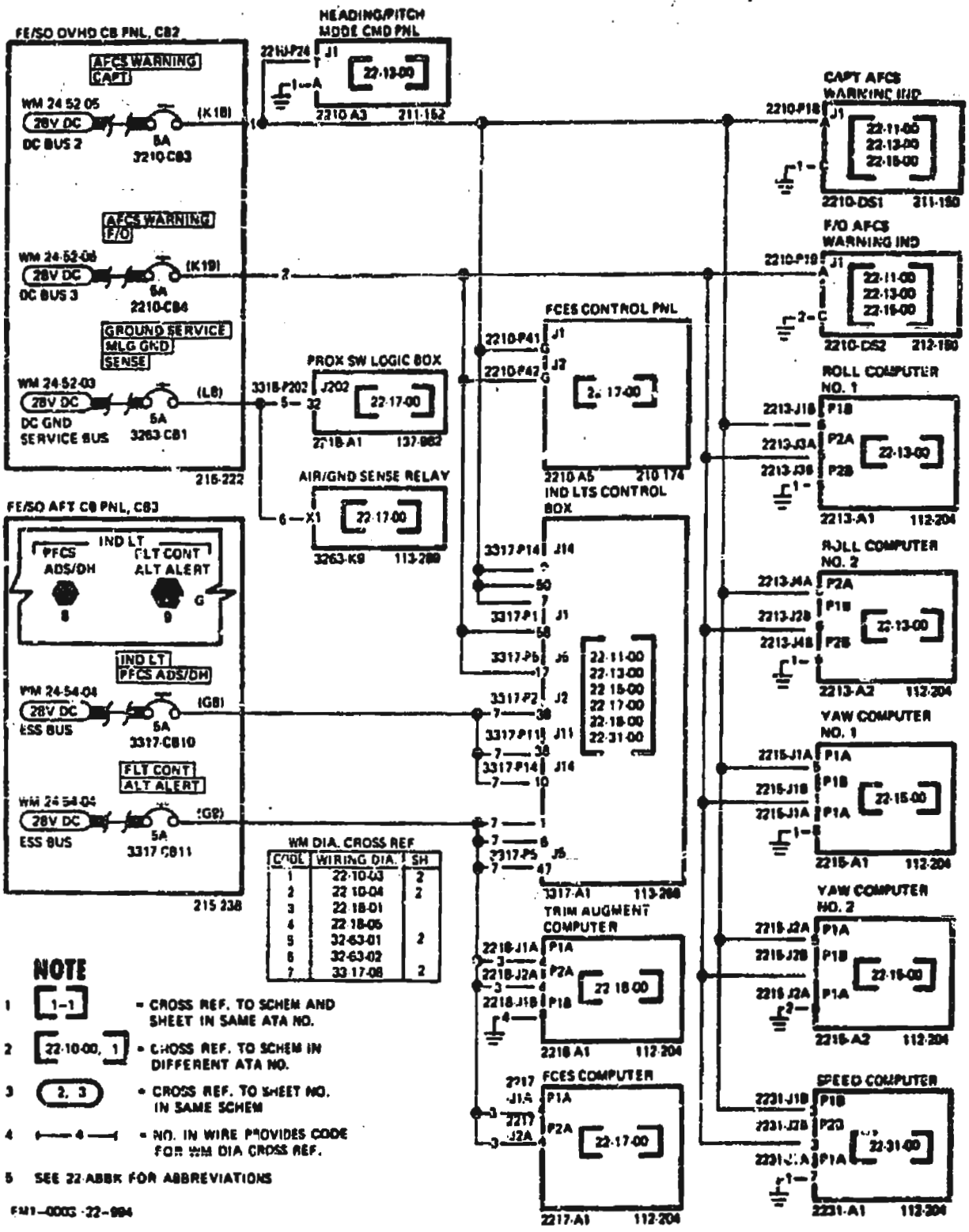
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-10-02	2
2	22-10-04	2
3	22-17-01	1
4	22-17-08	1
5	22-17-08	1
6	22-17-08	2
7	22-17-09	1
8	22-17-16	1
9	22-17-16	1
10	22-21-01	1
11	22-21-02	1
12	22-21-02	3
13	27-61-03	1
14	32-61-03	1

R AFCS Primary Power Distribution, FE/SO Overhead CB Panel,
R CB2 and Aft CB Panel CB3 Schematic
R SCHEM 3 (Sheet 1)

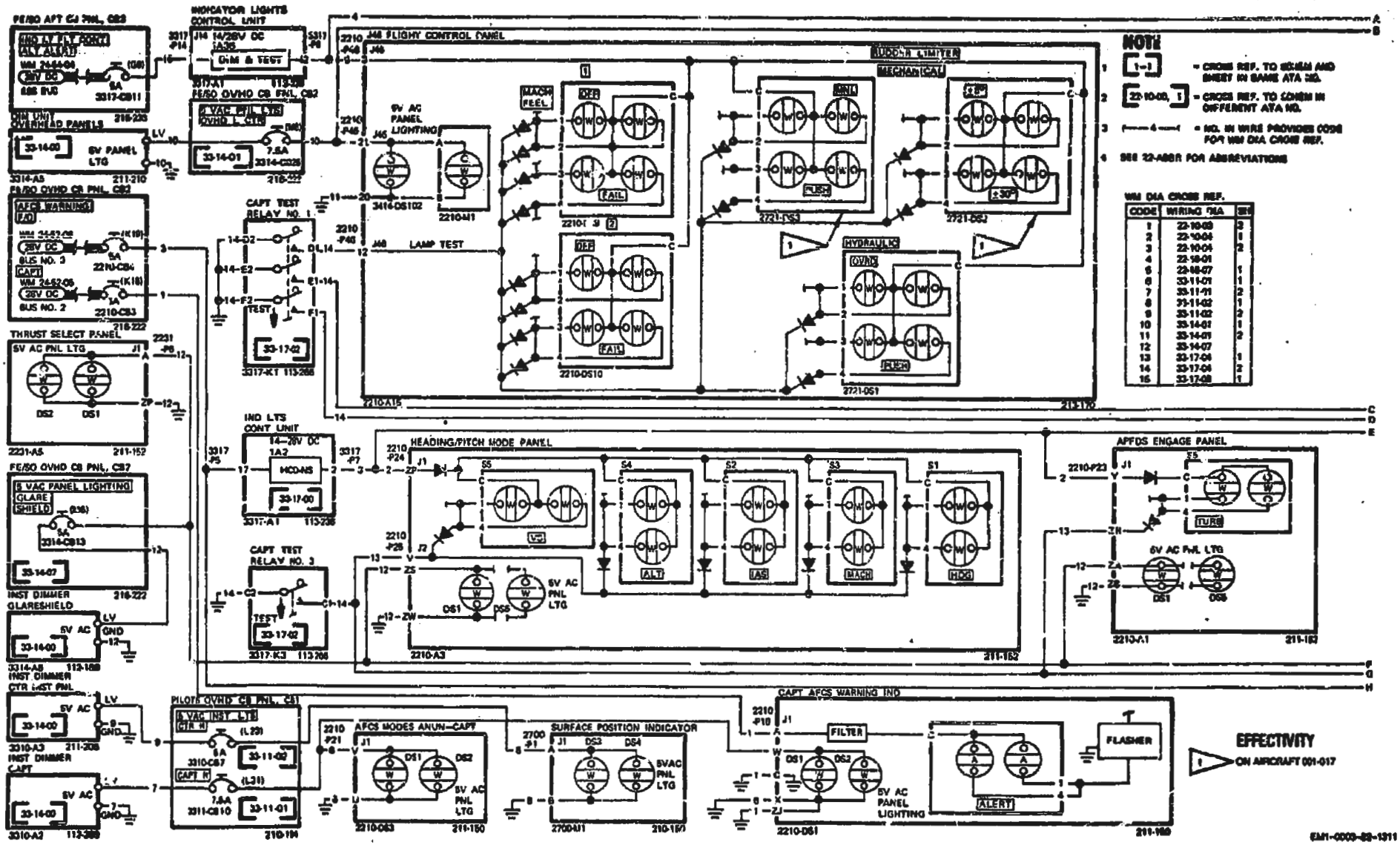
EFFECTIVITY: ALL

001B



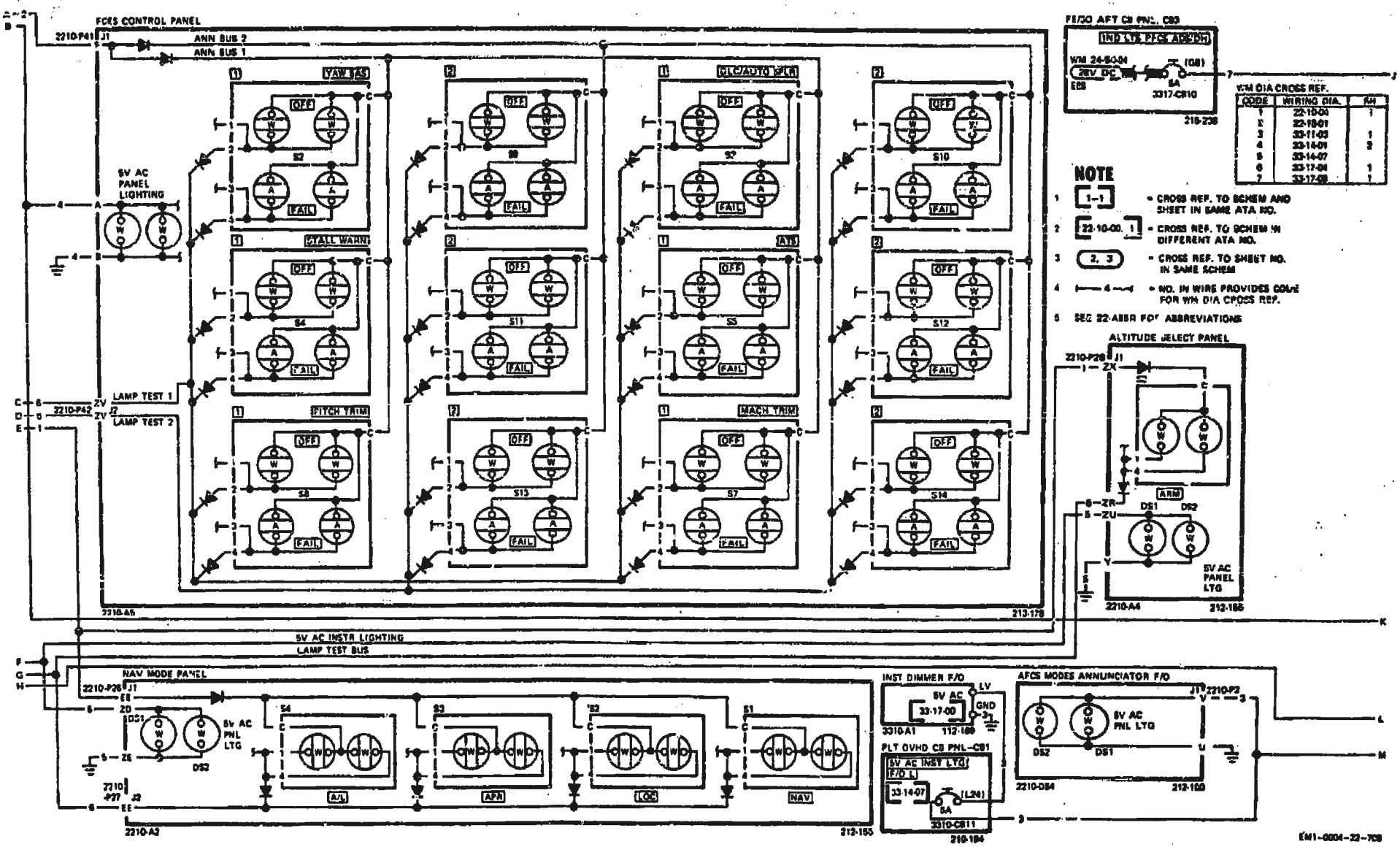
R AFCS Primary Power Distribution, FE/SO Overhead CB Panel,
R CB2 and Aft CB Panel, CB3 Schematic
R SCHEM 3 (Sheet 2)

EFFECTIVITY: ALL



R AFCS Control Panel Lamp Test and Dimming Schematic
R SCHEM 4 (Sheet 1)

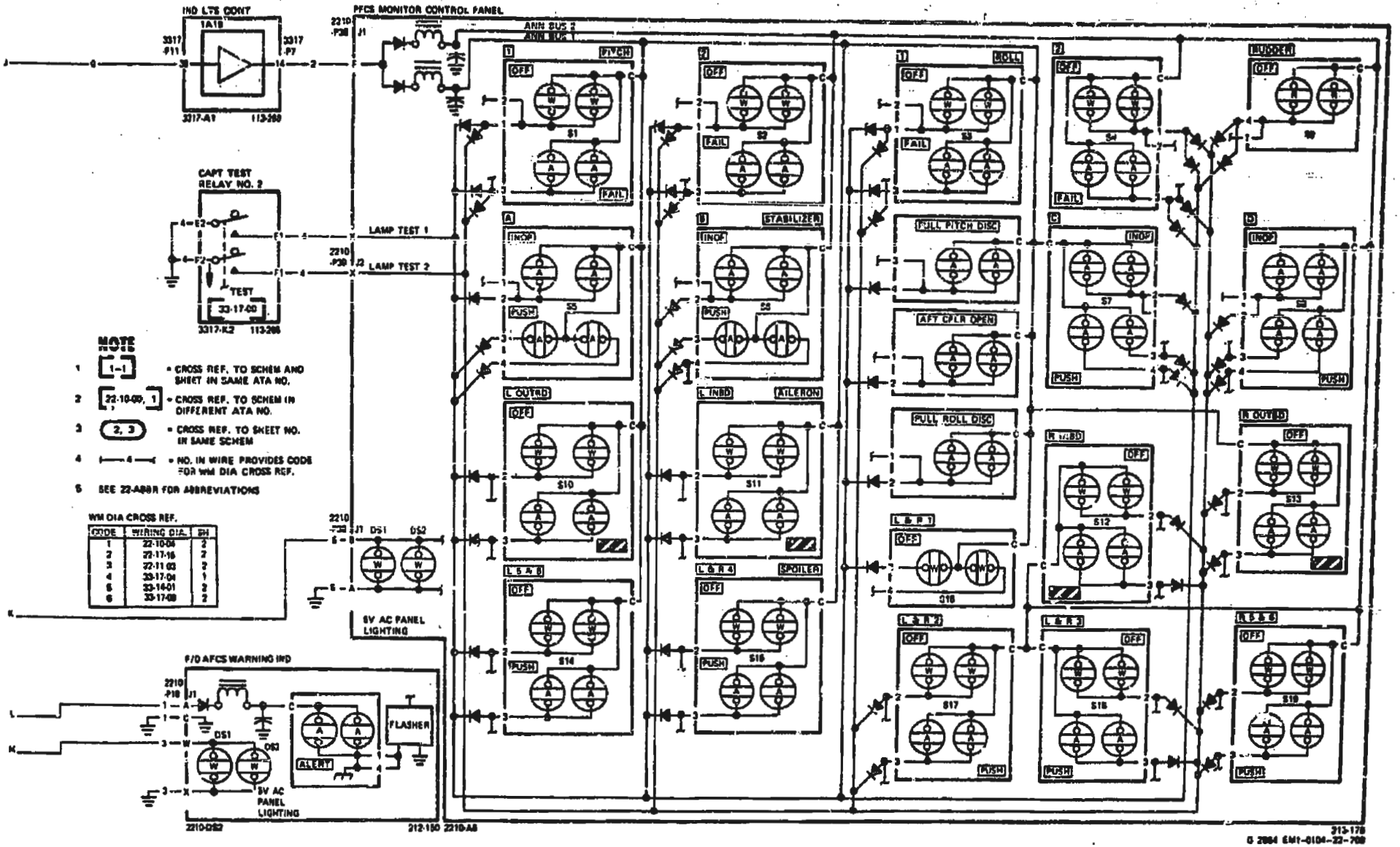
EFFECTIVITY: ALL



R AFCS Control Panel Lamp Test and Dimming Schematic
R SCHEM 4 (Sheet 2)

EFFECTIVITY: ALL

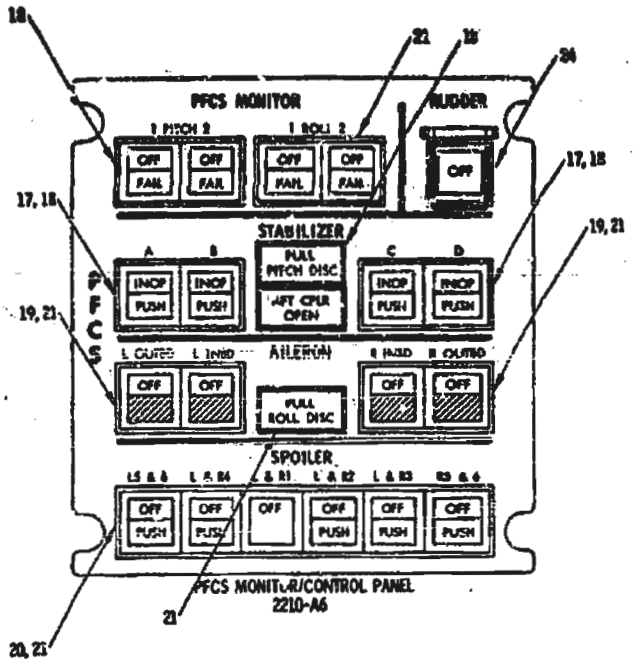
001B



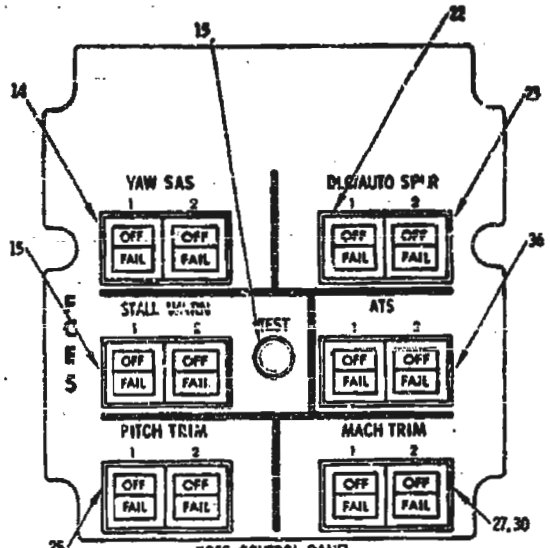
AFCS Control Panel Lamp Test and Dimming Schematic
SCHEM 4 (Sheet 3)

EFFECTIVITY: ALL

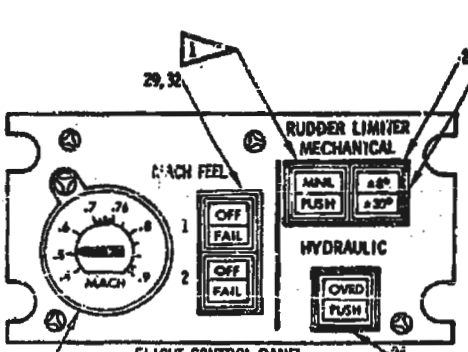
001B



PFCS MONITOR/CONTROL PANEL
2210-A6

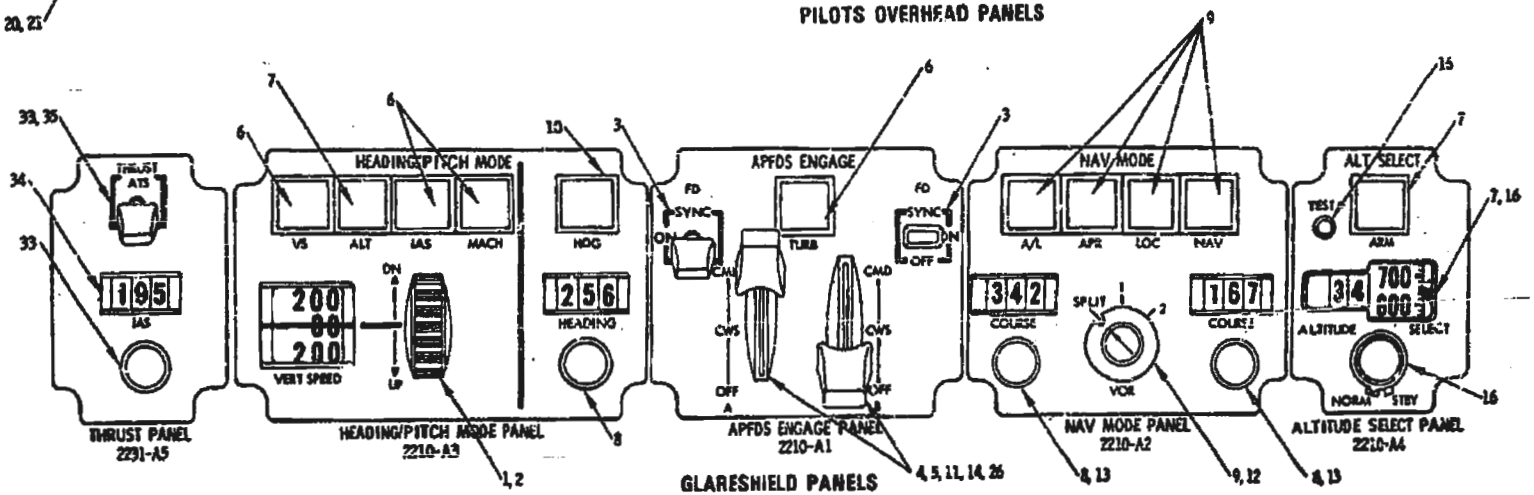


FCES CONTROL PANEL
2210-A5



FLIGHT CONTROL PANEL
2210-A15

PILOTS OVERHEAD PANELS



THRUST PANEL
2231-A5

HEADING/PITCH MODE PANEL
2210-A3

APFDS ENGAGE PANEL
2210-A1

NAV MODE PANEL
2210-A2

ALTITUDE SELECT PANEL
2210-A4

GLARESHIELD PANELS

LEGEND

ITEM	ATA NO.	WIRE SCH
1	22-11-00	5
2	22-11-00	6
3	22-11-00	8
4	22-11-00	9
5	22-11-00	16
6	22-11-00	13
7	22-11-00	14
8	22-13-00	5
9	22-13-00	7
10	22-13-00	8
11	22-13-00	10
12	22-13-00	14
13	22-15-00	4
14	22-15-00	5
15	22-17-00	3
16	22-17-00	4
17	22-17-00	5
18	22-17-00	6
19	22-17-00	7
20	22-17-00	8
21	22-17-00	9
22	22-17-00	11
23	22-17-00	12
24	27-21-00	1
25	22-18-00	3
26	22-18-00	4
27	22-18-00	6
28	22-18-00	7
29	22-18-00	8
30	22-21-00	3
31	22-21-00	4
32	22-21-00	5
33	22-31-00	2
34	22-31-00	4
35	22-31-00	6
36	22-31-00	9

EFFECTIVITY

1 ON AIRCRAFT 001-017

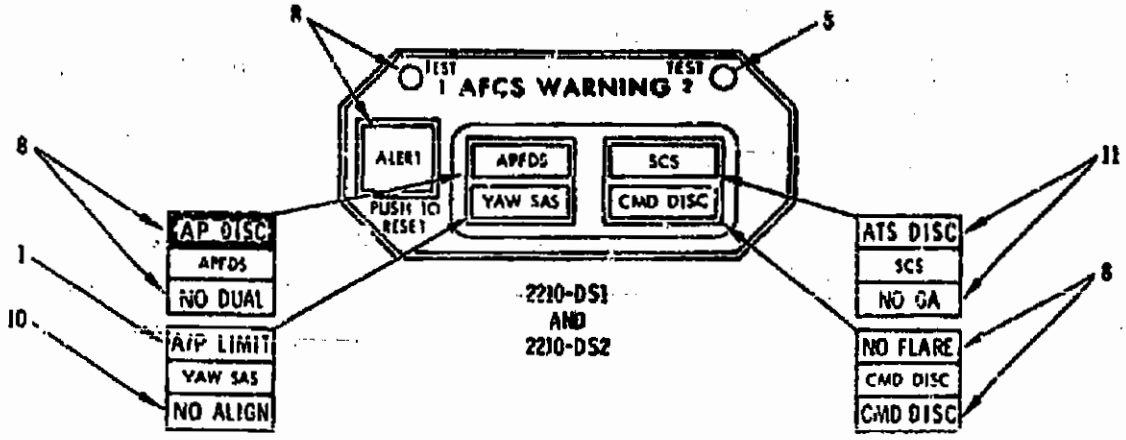
EM1-0000-00-1014

R AFCS Schematic Home Diagram
R SCHEM 5 (Sheet 1)

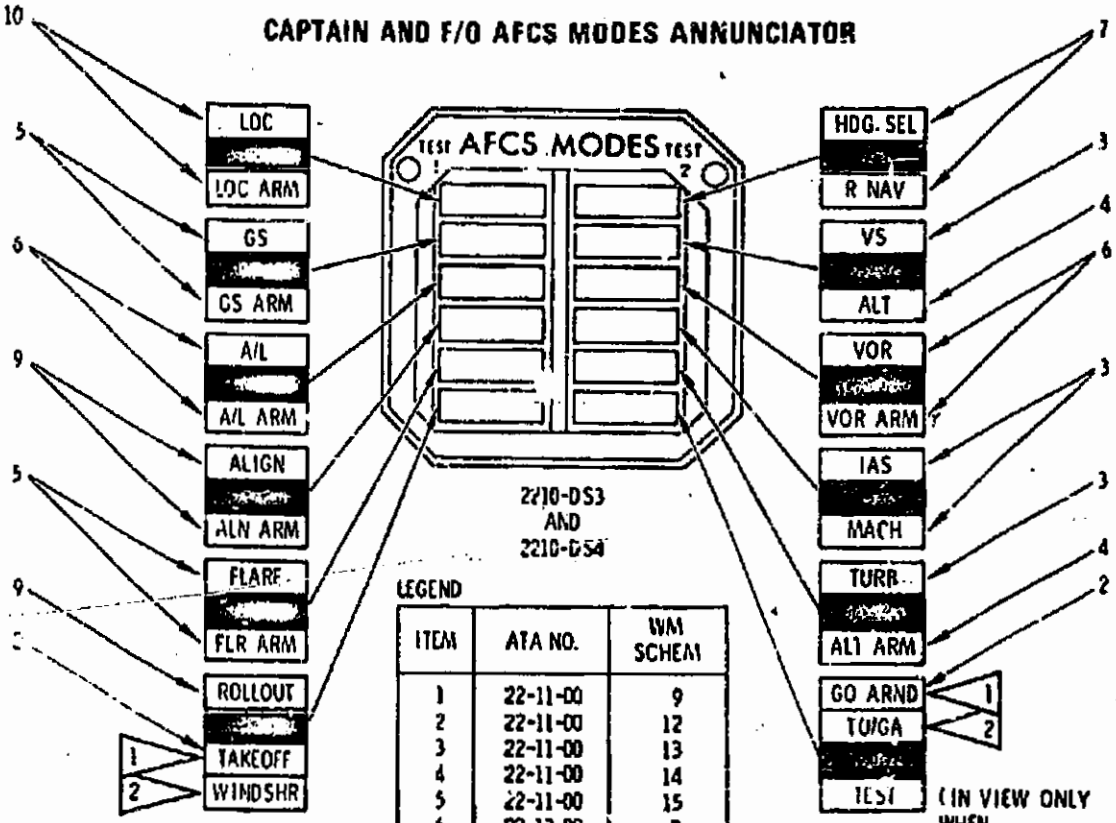
EFFECTIVITY: ALL

0018

CAPTAIN AND F/O AFCS WARNING INDICATOR



CAPTAIN AND F/O AFCS MODES ANNUNCIATOR



LEGEND

ITEM	ATA NO.	WM SCHEM
1	22-11-00	9
2	22-11-00	12
3	22-11-00	13
4	22-11-00	14
5	22-11-00	15
6	22-13-00	7
7	22-13-00	8
8	22-13-00	11
9	22-15-00	6
10	22-15-00	7
11	22-31-00	8

NOTE

1 AIRCRAFT WITHOUT SB 34-178

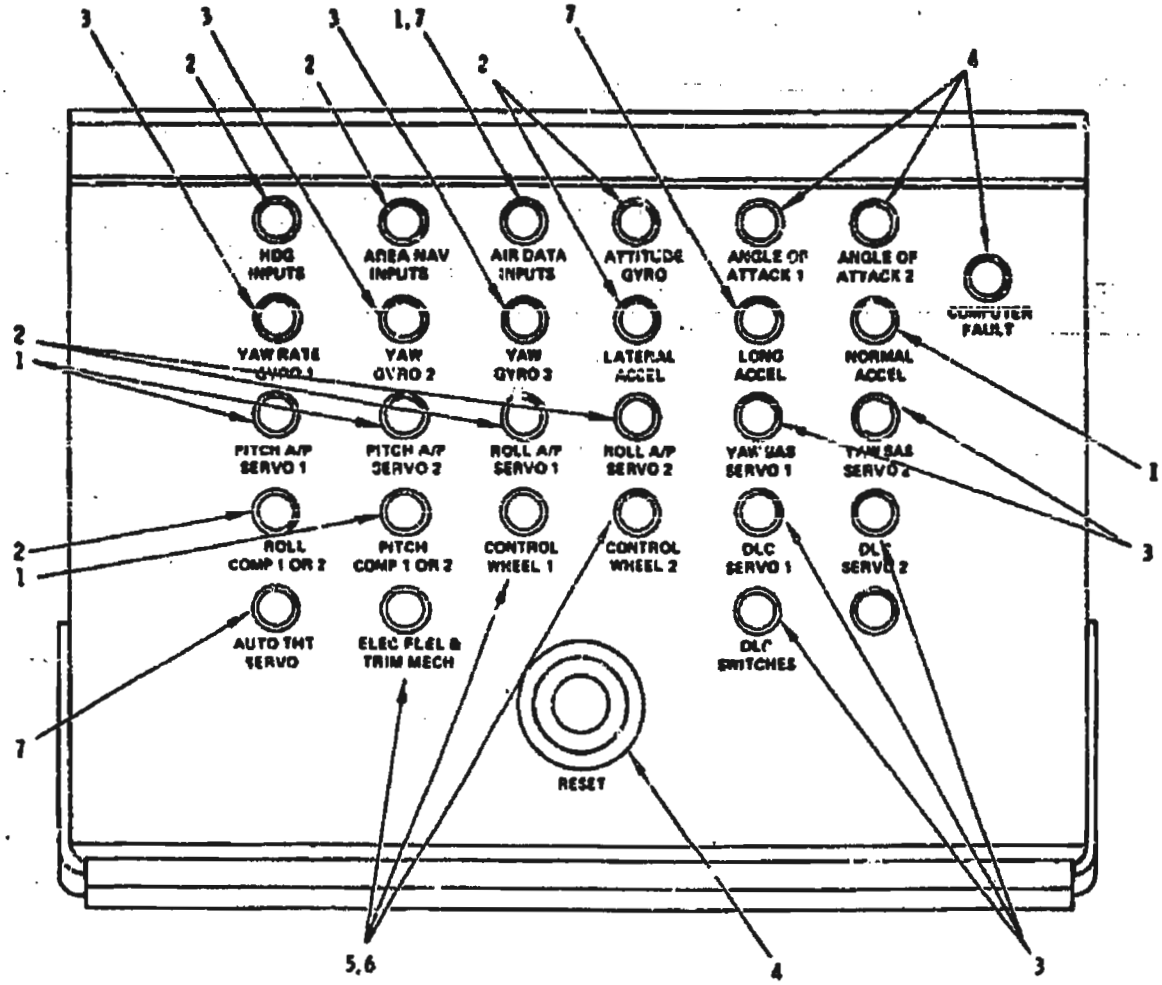
2 AIRCRAFT WITH SB 34-178

(IN VIEW ONLY WHEN TEST-2 SWITCH IS DEPRESSED)

EMI-0001-22-4382

R AFCS Schematic Home Diagram
R SCHEM 5 (Sheet 2)

EFFECTIVITY: ALL



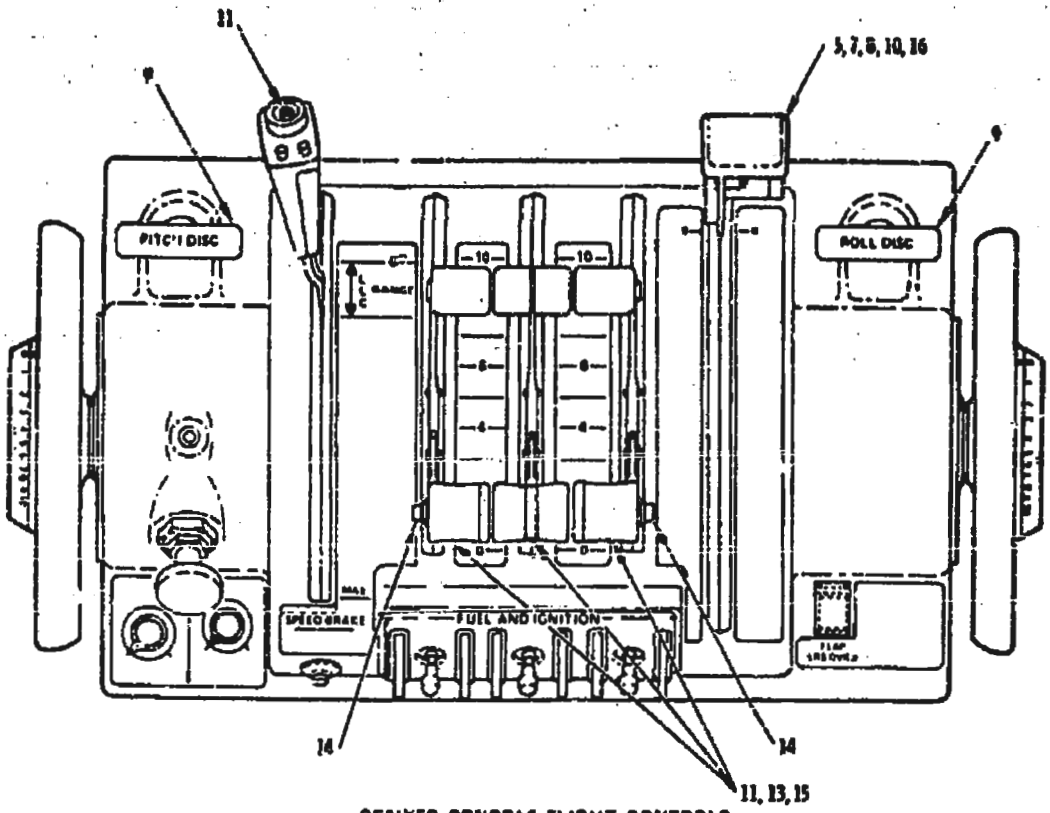
ITEM	ATA NO.	WM SCHEM
1	22-11-00	16
2	22-13-00	14
3	22-15-00	9
4	22-17-00	13
5	22-18-00	9
6	22-21-00	5
7	22-31-00	10

EM1-0002-22-991

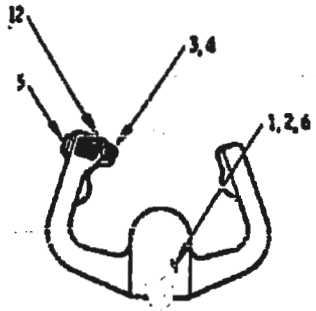
R AFCS Schematic Home Diagram
R SCHEM 5 (Sheet 3)

EFFECTIVITY: ALL

001B



CENTER CONSOLE FLIGHT CONTROLS



CAPTAIN CONTROL WHEEL
(FIRST OFFICER CONTROL WHEEL IS MIRROR IMAGE OF ABOVE)

LEGEND

ITEM	ATA NO.	WM SCHEM
1	22-11-00	5
2	22-11-00	6
3	22-11-00	9
4	22-11-00	10
5	22-11-00	12
6	22-13-00	4
7	22-15-00	8
8	22-17-00	3
9	22-17-00	6
10	22-17-00	8
11	22-17-00	11
12	22-18-00	2
13	22-31-00	2
14	22-31-00	6
15	22-31-00	7
16	22-31-00	8

EM1-5002-22-770

R R AFCS Schematic Home Diagram
SCHEM 5 (Sheet 4)

R R EFFECTIVITY: ALL

0018

"AND" GATE

ALL INPUTS MUST BE "ONES" TO PRODUCE A "ONE" IN THE OUTPUT

"NAND" GATE

THE ABSENCE OF A ONE ON ANY INPUT PRODUCES A "ONE" IN THE OUTPUT

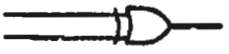
"NAND" GATE

THE ABSENCE OF A "ONE" ON ANY INPUT PRODUCES A "ONE" IN THE OUTPUT

"OR" GATE

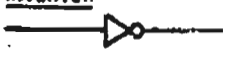
THE FIRST INPUT TO BECOME "ONE" PRODUCES A "ONE" IN THE OUTPUT

"EXCLUSIVE OR" GATE



ANY DIFFERENCE BETWEEN BOTH INPUTS PRODUCES A "ONE" IN THE OUTPUT

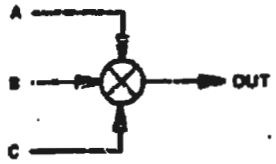
INVERTER



CONVERTS LOGIC "ZERO" TO "ONE" OR "ONE" TO "ZERO"

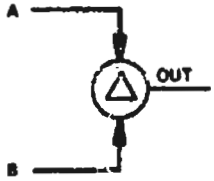
TIME DELAY

ANALOG SIGNAL SUMMING POINT



PROVIDES SIGNAL CONDITIONING AND ISOLATION OF SOURCES

MONITOR COMPARATOR



COMPARES A AND B ANALOG SIGNAL AND PROVIDES A LOGIC FAIL IF PROGRAM LIMIT IS EXCEEDED

SIGNAL FLOW PENNANT

DISTINGUISHES ANALOG SIGNAL FLOW CROSS REFERENCE FROM MNEMONIC LOGIC TERM REFERENCE

FIM - FAULT ISOLATION MONITOR

LATCHING MAGNETIC SPHERE
BLACK = NO FAULT
WHITE OR YELLOW = FAULT

NOTE

1. MNEMONIC LOGIC TERMS ARE DEFINED IN CHAP. 22 INDEX
2. LOGIC SYMBOLS ARE DISTINCTIVE SHAPE (ASA Y 32.14)
3. CIRCUITRY DEPICTED FOR FUNCTIONAL SYMBOLS ARE APPROXIMATE EXAMPLES

EM1-0101-22-799

APFDS Schematic Symbols
SCHEM 6 (Sheet 1)

EFFECTIVITY: ALL

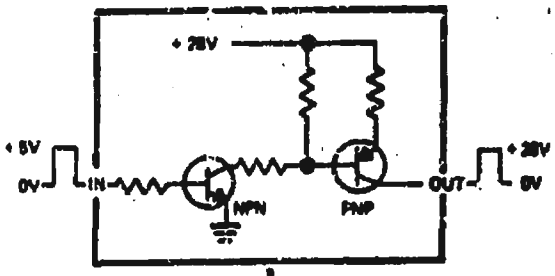
0016

DRIVER

DR

THE PRESENCE OF "ONE" PRODUCES A +28V DC SIGNAL

+5V TO +28V NON-INVERTING HIGH LEVEL LOGIC DRIVER



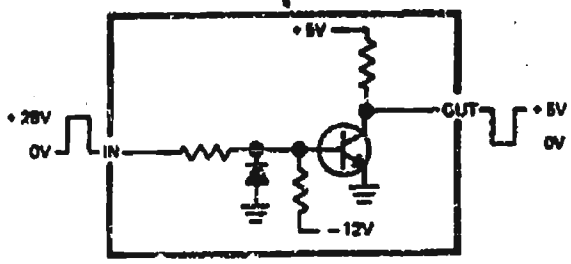
LOGIC LEVEL SHIFTER – LS

LS

NI LS

LARGE TO SMALL SHIFT +28V TO +5 LEVEL INVERTING (SHOWN)

(NON-INVERTING)



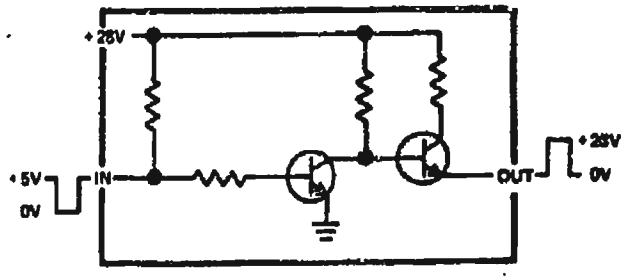
LOGIC LEVEL SHIFTER – SL

SL

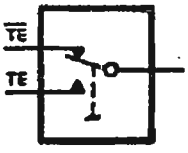
NI SL

SMALL TO LARGE SHIFT +5 TO +28V LEVEL INVERTING (SHOWN)

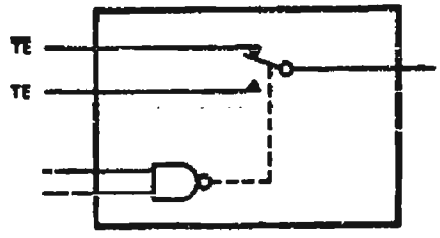
(NON-INVERTING)



SOLID-STATE RELAY



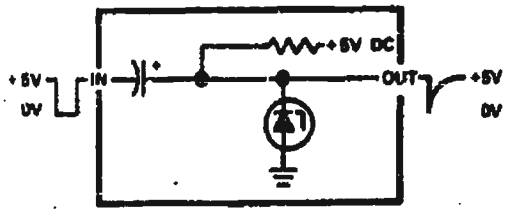
CONTACTS USUALLY SHOWN ON SIGNAL FLOW DIAGRAM AND LOGIC GATE ON LOGIC DIAGRAM



ONE SHOT TRIGGER

OS

PROVIDES OUTPUT WHEN INPUT CHANGES FROM LOGIC 1 TO 0

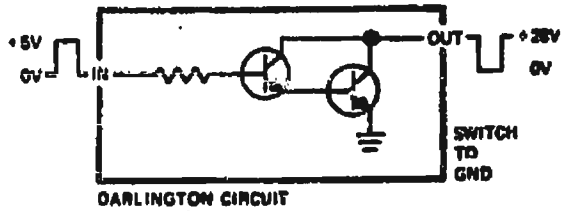


ANNUNCIATOR DRIVER/SWITCH

ANN DRVR

SW

THE PRESENCES OF "ONE" PRODUCES A GROUND SIGNAL TO DRIVER ANNUNCIATOR



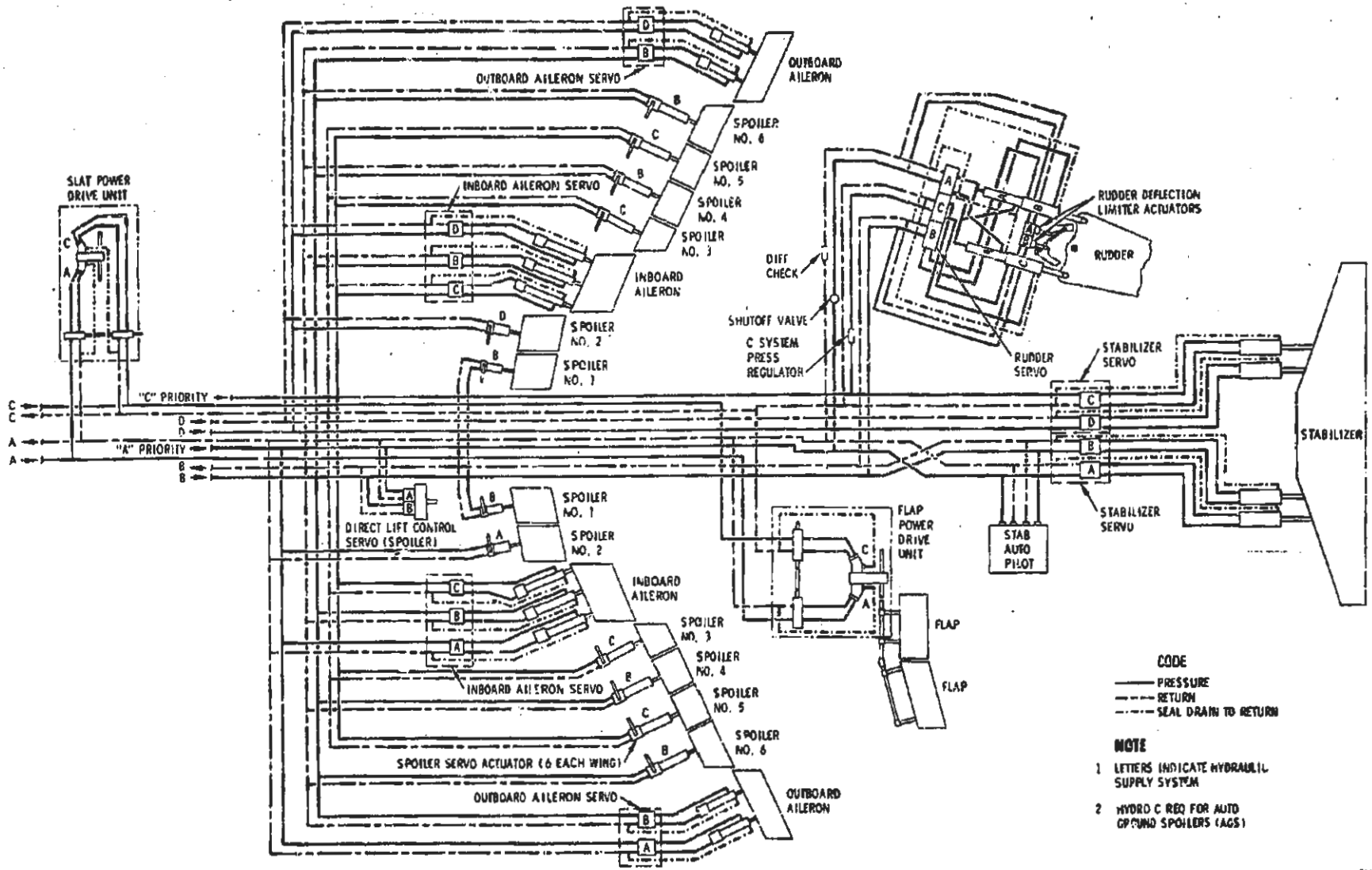
DARLINGTON CIRCUIT INVERTING

EM1-0101-22-214

R R APFDS Schematic Symbols
SCHEM 6 (Sheet 2)

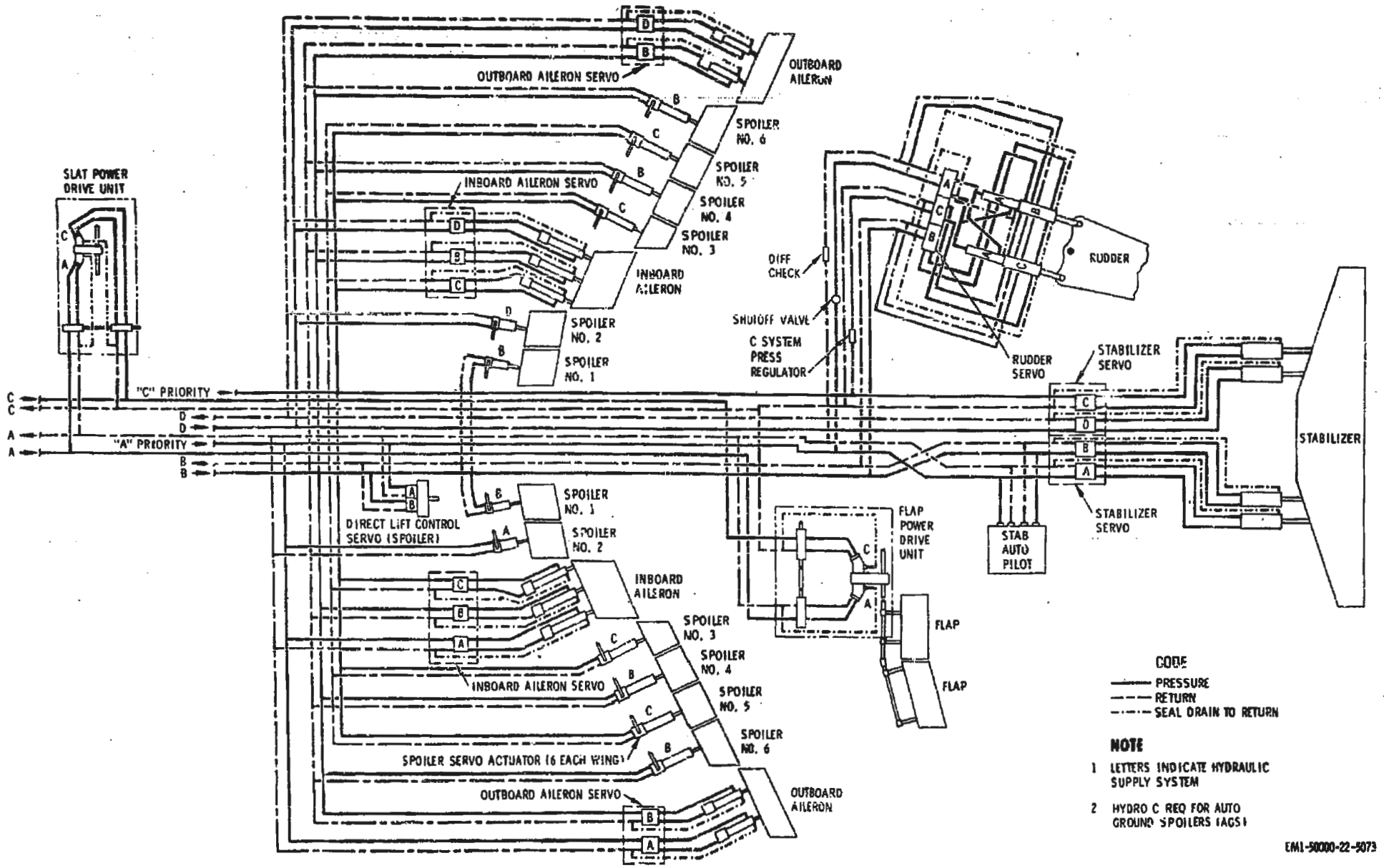
EFFECTIVITY: ALL

0018



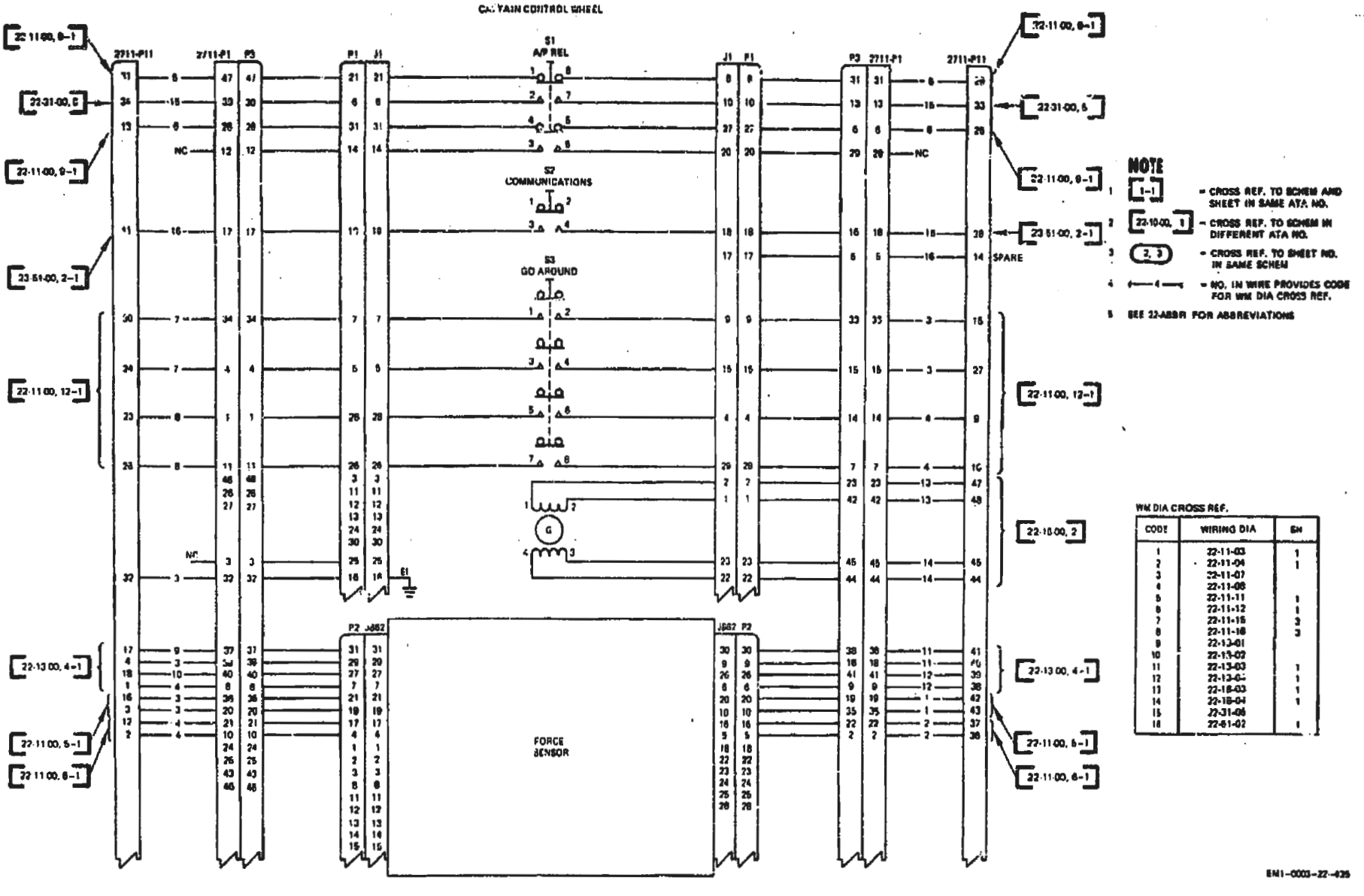
Flight Controls Hydraulic Power Distribution Schematic
SCHEM 7

R
R
001B EFFECTIVITY: 001-017



R Flight Controls Hydraulic Power Distribution Schematic
R SCHEM 7

EFFECTIVITY: 018-999



NOTE

1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM

4 ←4→ = NO. IN WIRE PROVIDES CODE FOR WK DIA CROSS REF.

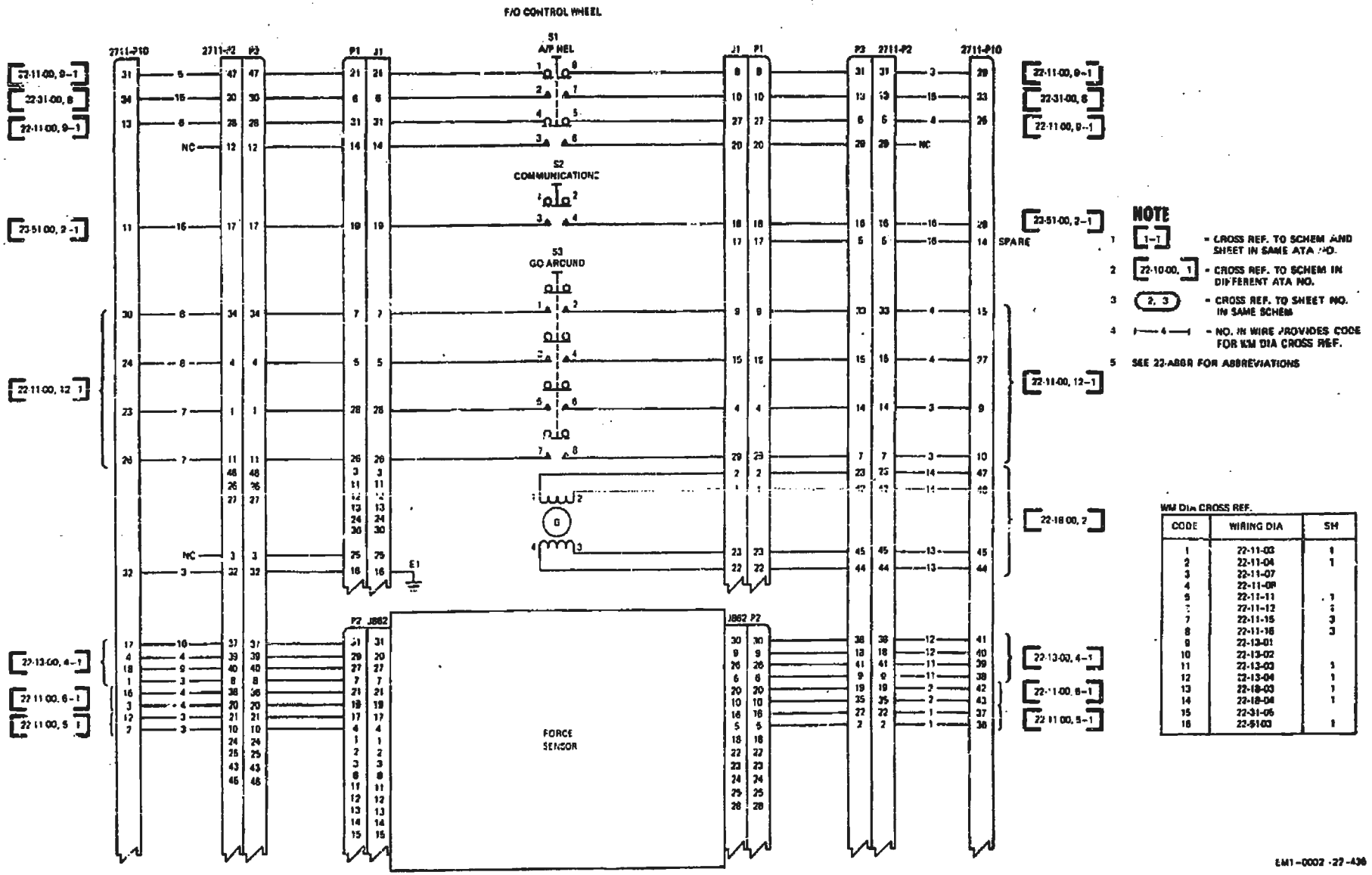
5 SEE 22-ABBR FOR ABBREVIATIONS

WK DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-11-03	1
2	22-11-04	1
3	22-11-07	
4	22-11-08	
5	22-11-11	1
6	22-11-12	1
7	22-11-15	3
8	22-11-16	3
9	22-13-01	
10	22-13-02	
11	22-13-03	1
12	22-13-04	1
13	22-16-03	1
14	22-16-04	1
15	22-31-06	
16	22-61-02	1

EM1-0003-22-035

Captains Control Wheel Schematic
SCHEM 8



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. 4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

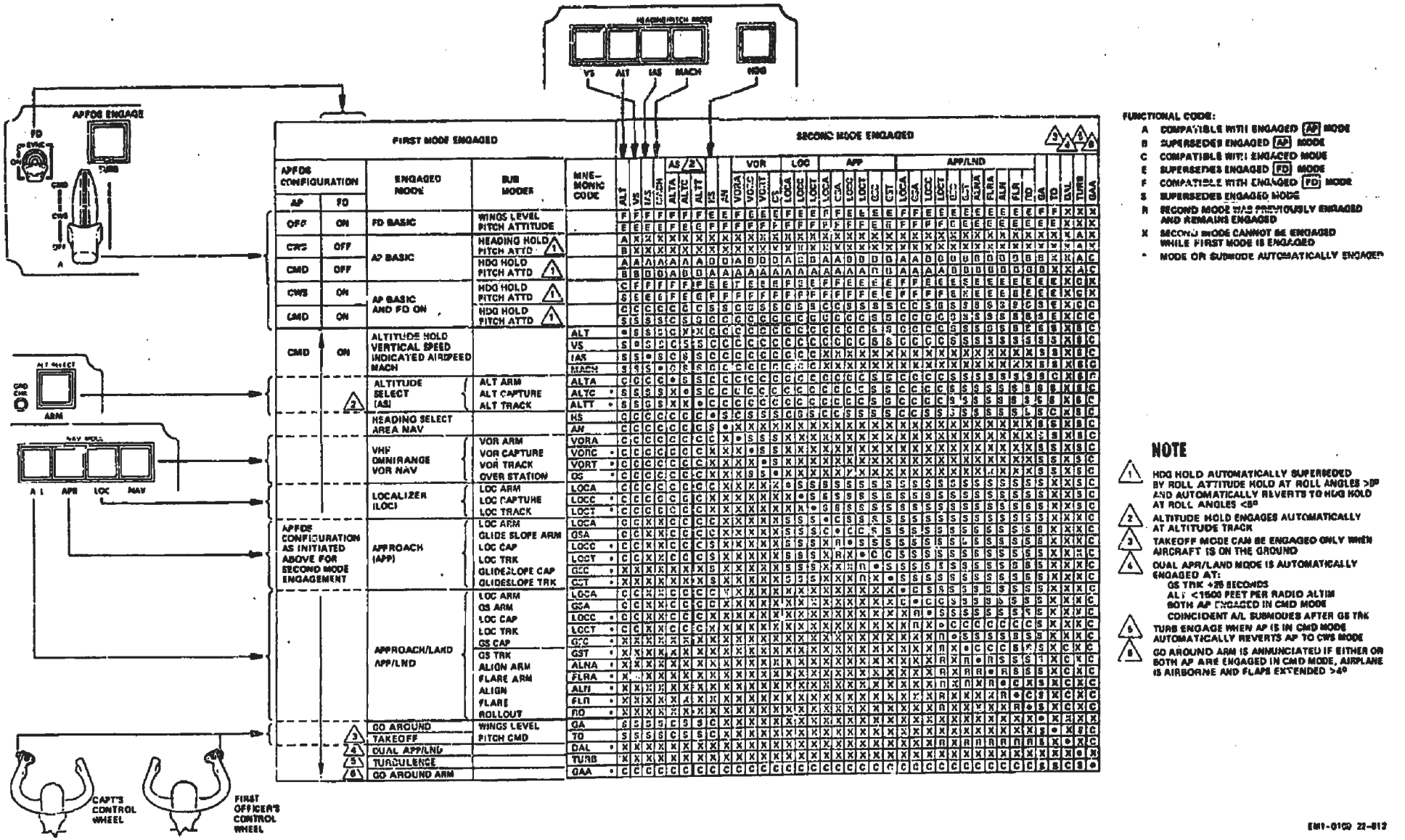
WM Dia CROSS REF.

CODE	WIRING DIA	SH
1	22-11-03	1
2	22-11-04	1
3	22-11-07	
4	22-11-08	
5	22-11-11	1
6	22-11-12	1
7	22-11-15	3
8	22-11-16	3
9	22-13-01	
10	22-13-02	
11	22-13-03	1
12	22-13-04	1
13	22-18-03	1
14	22-18-04	1
15	22-31-05	
16	22-5103	1

EM1-0002-22-436

First Officers Control Wheel Schematic
SCHEM 9

R EFFECTIVITY: ALL
R
001B



FUNCTIONAL CODE:

- A COMPATIBLE WITH ENGAGED [AP] MODE
- B SUPERSEDES ENGAGED [AP] MODE
- C COMPATIBLE WITH ENGAGED MODE
- E SUPERSEDES ENGAGED [FD] MODE
- F COMPATIBLE WITH ENGAGED [FD] MODE
- S SUPERSEDES ENGAGED MODE
- R SECOND MODE WAS PREVIOUSLY ENGAGED AND REMAINS ENGAGED
- X SECOND MODE CANNOT BE ENGAGED WHILE FIRST MODE IS ENGAGED
- * MODE OR SUBMODE AUTOMATICALLY ENGAGED

NOTE

1. HDG HOLD AUTOMATICALLY SUPERSEDED BY ROLL ATTITUDE HOLD AT ROLL ANGLES >5° AND AUTOMATICALLY REVERTS TO HDG HOLD AT ROLL ANGLES <5°
2. ALTITUDE HOLD ENGAGES AUTOMATICALLY AT ALTITUDE TRACK
3. TAKEOFF MODE CAN BE ENGAGED ONLY WHEN AIRCRAFT IS ON THE GROUND
4. DUAL APR/LAND MODE IS AUTOMATICALLY ENGAGED AT:
   - GS TRK +2ß SECONDS
   - ALT <1500 FEET PER RADIO ALTIM
   - BOTH AP ENGAGED IN CMD MODE
   - COINCIDENT A/L SUBMODES AFTER GS TRK
5. TURB ENGAGE WHEN AP IS IN CMD MODE AUTOMATICALLY REVERTS AP TO CWS MODE
6. GO AROUND ARM IS ANNUNCIATED IF EITHER OR BOTH AP ARE ENGAGED IN CMD MODE, AIRPLANE IS AIRBORNE AND FLAPS EXTENDED >4°

EM1-0100 22-813

AFCS Mode Priority and Mode Compatibility Matrix
SCHEM 10

R EFFECTIVITY: ALL
R
001B

AUTO FLIGHT - ADJUSTMENT AND TEST

1. General

The auto flight system adjustment and test contains the following test procedures:

A. AFCS Operation - General Check (See Table 501):

This procedure may be used to check that all components of the avionics flight control system (AFCS) are installed and operational. Its use should be limited to those cases in which a rapid verification of correct system operation is desired (for example, after a system wiring change). It is not a detailed test, and the fault isolation procedures contained in this manual should be performed if a thorough system check is desired. Also, if a system component is replaced, its individual removal and installation test procedure should be used, rather than performing a general (and more lengthy) check on the entire system.

B. DANA/NO DUAL Test (See Table 502):

This procedure is used to check for a system fault which results in display of a DUAL A/L NOT AVAIL (DANA) advisory message and/or a NO DUAL warning message. If a fault is confirmed, the DUAL A/L NOT AVAIL (DANA) ANNUNCIATION RAPID FAULT ISOLATION procedure (Ref. 22-12-37) may be used to identify the faulted system component. If the test does not confirm that a fault is present, the extended DANA/NO DUAL test described in Paragraph 1C below may be used as a further check to verify that a gyro or accelerometer fault is not present.

R

C. Extended DANA/NO DUAL Test (See Table 503):

This procedure is used in the event that performance of the DANA/NO DUAL Test described in Paragraph 1B above does not indicate that a system fault is present. It checks that the signal outputs of the normal and lateral accelerometers, yaw rate gyros, and roll/pitch attitude sensors are within specified limits when they are exercised.

D. Successful Completion of Test

Successful completion of any of the above procedures requires that all autoflight system components and associated equipment are installed and operational. Also, performing concurrent tests on other aircraft systems should

be avoided, since they may interfere with the performance of these tests.

2. Equipment and Materials

A. AFCS Operation - General Check:

RAT Ground Safety Lock (Ref. 29-21-00)

B. DANA/NO DUAL Test:

RAT Ground Safety Lock (Ref. 29-21-00)

Radio Altimeter Test Set, Collins Radio 980N-1 with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable Assembly (see Paragraph 5A Note 2)

R NOTE: To preclude possible radio altimeter mutual
R interference problems, use of the 980N-1 Dual Adapter
R (active) cable, with the radio altimeter test set is
R recommended.

R If the 980N-1 (passive) Adapter Cable is used for
R autoland testing, temporary shielding of the radio
R altimeter antennas may be required for successful
R completion of the test.

R CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED
R FOR SHIELDING MUST BE SUCH THAT REMOVAL BEFORE
R FLIGHT IS GUARANTEED.

VOR/ILS Ramp Test Set T-30, or equivalent

C. Extended DANA/NO DUAL Test:

RAT Ground Safety Lock (Ref. 29-21-00)

VOR/ILS Ramp Test Set T-30, or equivalent

Attitude System Test Set, G/ITEL 34-21-77

3. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test

	29-11-00	Hydraulic Power System - Maintenance Practices
	29-21-00	Ram Air Turbine - Maintenance Practices
	32-63-00	Air/Ground Sensing System - Maintenance Practices
R	34-14-00	Air Data Computer System - Maintenance Practices
	34-21-00	Attitude Reference System - Maintenance Practices
	34-22-00	Magnetic Heading Reference System - Maintenance Practices
	34-32-00	Radio Altimeter System - Maintenance Practices
	34-33-00	Instrument Landing System - Maintenance Practices
	34-55-00	VOR System - Maintenance Practices

4. AFCS Operation - General Test

A. General

The General Test (Ref. Table 501) consists of the following: Set Up, Altitude Alert Check, Electrical Pitch Trim Check, Direct Lift Control/Auto Ground Spoiler Check, Speed Control Check, APFDS Engage Logic Check and Test Completion. The General Test procedures are performed "in-part" or "in-total" on an as required basis. When performing "in-part", first perform the Set Up procedure, then the desired test procedure and Test Completion.

AFCS Operation - General Test
Table 501

SET UP	ACTION	CHECK
	SET UP	
1.	Turn on electrical power (Ref. 24-00-00).	
2.	.....	Avionics cooling is on (Ref. 21-00-00).
	WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM. LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED. TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT. THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.	
3.	Turn on hydraulic systems as required (Ref. 29-11-00): Hydro A, B, C and D for Pitch Axis Monitoring check.	
R	Hydro A, B, C and D for DLC/AGS Check. Hydro A and B for Electrical Pitch Trim Check, Speed Control Check, and APFDS Engage Logic Check.	
	NOTE: The Air Turbine Motor (ATM) must be selected to the ON position. Selection of AUTO can create ground test problems.	

AFCS Operation - General Test (Cont)
Table 501

SET UP	ACTION	CHECK
	SET UP	
4.	.....	Verify that the following systems are on: Air data computer (Ref. 34-14-00) Attitude Reference System (Ref. 34-21-00) Magnetic Heading Reference System (Ref. 34-22-00) Radio Altimeter System (Ref. 34-32-00) Instrument Landing System (Ref. 34-33-00) Inertial Navigation System (Ref. 34-43-00) (If installed) VOR (Ref. 34-55-00)
5.	.....	On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed: AUTO THROT SERVO (A1) SPEED CONT (A2) (A20) YAW SAS (A5) (A23) PITCH & ROLL (A6) (A24) TRIM AGMT AC (A7) (A25) TRIM AGMT DC (A8) (A26) AFCS MODE IND (B3) (B19) FCES COMPUTERS DC (B4) FCES COMPUTERS AC&L AOA (B5) FCES STICK SHAKE (B6) SPOILER DWELL DC (B7) SPOILER DWELL AC (B8) NO. 1 AFT COUPLER (B9) NO. 2 AFT COUPLER (B27) ALT ALERT 1 (K27) ALT ALERT 2 (J21)

AFCS Operation - General Test (Cont)
Table 501

SET UP	ACTION	CHECK
	.....	On Flight Engineers/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed: FLIGHT STATION MISC R AOA (F1) STICK SHAKE (F2) AFCS WARNING CAPT (K18) F/O (K19) On Flight Engineers/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed: INT LT PFCS ADS/DH (G8) FLT CONT ALT ALERT (G9)
6.	On pilots overhead circuit breaker panel CB1: open and tag MISC - RAT AUTO DEPLOY (L3) circuit breaker.	
7.	Install RAT ground safety lock (Ref. 29-21-00).	
8.	.....	All FIM annunciators are black on all autoflight system computers.

WARNING: VERIFY THAT STEPS 9 THROUGH 11 HAVE BEEN PERFORMED BEFORE THE THROTTLE LEVERS ARE MOVED TO THE REVERSE THRUST POSITION.

AFCS Operation - General Test (Cont)
Table 501

SET UP	ACTION	CHECK
	SET UP	
9.	On pilots overhead circuit breaker panel CB1: open the following circuit breakers. THRUST REVERSE ENG 1 (H16) ENG 2 (H17) ENG 3 (H18)	
10.	On FE/SO ENGINE BLEED CONTROL panel: depress three ENG ISLN VALVE switchlights and three HI PRESS valve switchlights to OFF.	Verify that switchlights indicate OFF and flow bars are dark.
11.	.....	Verify that thrust reversers on each engine are clear of personnel and equipment before proceeding.
12.	On center console, set manual PITCH TRIM WHEEL to an index of approximately 4.	
13.	On center console, set manual ROLL trim wheel to an index of zero.	

AFCS Operation - General Test
Table 501

ALTITUDE ALERT CHECK

TEST	ACTION	CHECK
1.	Using BARO SET knob: set Capt and F/O barometric altimeters to local barometric pressure.	
2.	On ALT SELECT panel: set NORM-STBY switch to NORM, and set ALTITUDE SELECT knob for an altitude 2000 feet above Capt barometric altimeter indication.	
3.	On APFDS ENGAGE panel: set FD A switch to ON.	On Capt ADI: command bar comes into view and is centered and level.
4.	On FE/SO overhead circuit breaker panel CB2: open FLT STA MISC R-AOA (F1) circuit breaker.	
5.	On ALT SELECT panel: depress ARM switchlight to turn on ARM light.	On both AFCS MODES annunciators: ALT ARM messages are displayed.
6.	On ALT SELECT panel: depress and hold TEST switch through Step 10.	
7.	Using ALTITUDE SELECT knob: slowly decrease selected altitude until both APPROACH indicators come on.	APPROACH indicators come on at 1000 (±100) feet above Capt barometric altimeter indication.
8.	Using ALTITUDE SELECT knob: slowly decrease selected altitude until a 0.5-second audio tone is heard, both APPROACH indicators go out, and ALTITUDE alert indicators come on.	

AFCS Operation - General Test (Cont)
Table 501

ALTITUDE ALERT CHECK

TEST	ACTION	CHECK
	The 0.5-second tone is heard at 500 (±100) feet above Capt barometric altimeter indication when approaching altitude. The APPROACH indicators go out, and the ALTITUDE indicators come on at 250 (±100) feet above Capt barometric altimeter indication.	
9.	Using ALTITUDE SELECT knob: slowly decrease selected altitude until ALT ARM messages are removed and ALT messages are displayed on AFCS MODES annunciators.	On HEADING/PITCH MODE panel: ALT light comes on. On ALT SELECT panel: ARM light goes out. On Capt ADI: command bar indicates level flight. Above actions occur at Capt barometric altimeter indication (±100 feet).
10.	Using ALTITUDE SELECT knob: slowly increase selected altitude until both ALTITUDE alert indicators go out and a 0.5-second audio tone is heard.	ALTITUDE alert indicators go out and a 0.5-second audio tone is heard 250 (±100) feet above Capt barometric altimeter indication.
	Continue to increase selected altitude until DEVIATION alert indicators flash.	DEVIATION indicators flash at 500 (±100) feet above Capt barometric indication.
11.	Release TEST switch.	
12.	Depress ALT switchlight to off.	

AFCS Operation - General Test (Cont)
Table 501

ALTITUDE ALERT CHECK

	TEST	ACTION	CHECK
	13.	On CB2: close F1 circuit breaker.	
	14.	On pilots overhead circuit breaker panel, CB1: open AFCS FCES AC & L AOA (B5) circuit breaker.	ALTITUDE ALERT indicators go off.
	15.	On ALT SELECT panel: set NORM-STBY switch to STBY, and set ALTITUDE SELECT knob for an altitude 2000 feet above F/O barometric altimeter indication.	
	16.	On APFDS ENGAGE panel: set FD A switch to OFF, and set FD B switch to ON.	On F/O ADI: command bar comes into view, and is centered and level.
	17.	On ALT SELECT panel: depress ARM switchlight to turn on ARM light.	On both AFCS MODES annunciators: ALT ARM messages are displayed.
	18.	On ALT SELECT panel: depress and hold TEST switch through Step 23.	
R	19.	Using ALTITUDE SELECT knob: slowly decrease selected altitude until both APPROACH indicators come on.	APPROACH indicators come on at 1000 (±100) feet above F/O barometric altimeter indication.
R	20.	Using ALTITUDE SELECT knob: slowly decrease selected altitude until a 0.5-second audio tone is heard, both APPROACH indicators go out, and ALTITUDE alert indicators come on.	The 0.5-second tone is heard at 500 (±100) feet above F/O barometric altimeter indication when approaching altitude. The APPROACH indicators go out, and the ALTITUDE indicators come on at 250 (±100) feet above F/O barometric altimeter indication.

AFCS Operation - General Test (Cont)
Table 501

	TEST	ACTION	CHECK
		ALTITUDE ALERT CHECK	
	21.	Using ALTITUDE SELECT knob: slowly decrease selected altitude until ALT ARM messages are removed and ALT messages are displayed on AFCS MODES annunciators.	ALT light comes on. On ALT SELECT panel: ARM light goes out. On F/O ADI: command bar indicates level flight. Above actions occur at F/O barometric altimeter indication (±100 feet).
R R	22.	Using ALTITUDE SELECT knob: slowly increase selected altitude until both ALTITUDE alert indicators go out and a 0.5-second audio tone is heard.	ALTITUDE alert indicators go out and a 0.5-second audio tone is heard 250 (±100) feet above Capt barometric altimeter indication.
R		Continue to increase selected altitude until DEVIATION alert indicators flash.	DEVIATION indicators flash at 500 (±100) feet above F/O barometric indication.
	23.	Release TEST switch.	
	24.	Depress ALT switchlight to off.	
	25.	On CB1: close B5 circuit breaker.	
	26.	Rotate ALTITUDE SELECT knob.	ALTITUDE ALERT indicators go off when ALTITUDE SELECT knob is rotated.
	27.	On APFDS ENGAGE panel, set FD B switch to OFF.	

AFCS Operation - General Test
Table 501

PFCS PITCH AXIS MONITORING CHECK

	TEST	ACTION	CHECK
R R R R		NOTE: The pitch control override bungee and aft coupler adjustment/test (Ref. 27-41-06) may be used as an alternate PFCS PITCH AXIS MONITORING CHECK.	
R R	1.	On PFCS panel: depress (in) all switchlights to on (dark).	
R	2.	On pilots center console: rotate clockwise, pull and lock PITCH DISC handle.	On handle: PITCH DISC legend comes on.
		NOTE: In following check, FLT CONT PANELS legend on pilots caution and warning panel comes on with a PFCS panel indication.	
	3.	Hold F/O control column and push forward on Capt control column.	On PFCS panel: PUSH legends on STABILIZER C and D switchlights come on.
R	4.	Release control column.	
R R R R	5.	On PFCS panel: release (out) PITCH 1 and 2 switchlights to OFF then depress (in) to on.	PUSH legends on STABILIZER C and D switchlights go out.
R R R	6.	Hold F/O control column and pull aft on Capt control column.	PUSH legends on STABILIZER C and D switchlights come on.
R	7.	Release control column.	
R R R	8.	Release (out) PITCH 1 and 2 switchlights to OFF and then depress (in) to on.	PUSH legends on STABILIZER C and D switchlights go out.
R R R	9.	Hold Capt control column and push forward on F/O control column.	PUSH legends on STABILIZER A and B switchlights come on.
R	10.	Release control column.	

AFCS Operation - General Test (Cont)
Table 501

PFCS PITCH AXIS MONITORING CHECK

TEST	ACTION	CHECK
11.	Release (out) PITCH 1 and 2 switchlights to OFF and then depress (in) to on.	PUSH legends on STABILIZER A and B switchlights go out.
12.	Hold Capt control column and pull aft on F/O control column.	PUSH legends on STABILIZER A and B switchlights come on.
13.	Release control column.	
14.	Hold F/O control column and push forward on Capt control column.	On PFCS panel: FAIL legends on PITCH 1 and 2 switchlights come on; and PUSH legends on STABILIZER C and D switchlights come on.
15.	Release control column.	
16.	On PFCS panel: release (out) STABILIZER A and B switchlights.	On PFCS panel: STABILIZER A and B switchlight legends change from PUSH to INOP; and PULL PITCH DISC and AFT CPLR OPEN legends come on. STABILIZER C and D PUSH switchlight legends go out.
17.	Depress (in) STABILIZER A and B switchlights.	STABILIZER A and B switchlight legends change from INOP to PUSH; and PULL PITCH DISC and AFT CPLR OPEN legends go out. STABILIZER C and D PUSH switchlight legends come on.

AFCS Operation - General Test (Cont)
Table 501

PFCS PITCH AXIS MONITORING CHECK		
TEST	ACTION	CHECK
18.	Release (out) STABILIZER C and D switchlights.	STABILIZER C and D legends change from PUSH to INOP; and PULL PITCH DISC and AFT CPLR OPEN legends come on. STABILIZER A and B PUSH switchlight legends go out.
19.	Depress (in) STABILIZER C and D switchlights.	STABILIZER C and D switchlight legends change from INOP to PUSH; and PULL PITCH DISC and AFT CPLR OPEN legends go out. STABILIZER A and B PUSH switchlight legends come on.
20.	Release (out) PITCH 1 and 2 switchlights to OFF then depress (in) to on.	On PFCS panel: all legends go dark.
21.	On pilots center console: release and push in PITCH DISC handle.	On handle: PITCH DISC legend goes out.

AFCS Operation - General Test
Table 501

PFCS ROLL AXIS MONITORING CHECK

	TEST	ACTION	CHECK
	1.	On PFCS panel: depress (in) all switchlights to on (dark).	
	2.	Turn off hydraulic systems A thru D (Ref. 29-11-00);	
R R		STAB INOP legends A through D come on.	
	3.	On pilots center console: pull and lock ROLL DISC handle.	On handle: ROLL DISC legend comes on.
		NOTE: In following check, FLT CONT PANELS legend on pilots caution and warning panel comes on with a PFCS panel indication.	
	4.	Hold F/O control wheel and turn Capt control wheel full counterclockwise, and wait 5 seconds.	On PFCS panel: AILERON L OUTBD and L INBD striped legends come on; PULL ROLL DISC legend comes on; and SPOILERS L5 & 6 and L & R4 switchlight PUSH legends come on.
	5.	Hold Capt control wheel and turn F/O control wheel full clockwise, and wait 5 seconds.	On PFCS panel: FAIL legends on ROLL 1 and 2 switchlights come on; AILERON R INBD and R OUTBD striped legends come on; and SPOILERS L & R2, L & R3, and R5 & 6 PUSH legends come on.
R	6.	On PFCS panel: release (out) ROLL 1 and 2 switchlights to OFF then depress (in) to on.	On PFCS panel: all legends except STAB INOP go dark.
	7.	On pilots center console: release and push in ROLL DISC handle.	On handle: ROLL DISC legend goes out.

AFCS Operation - General Test (Cont)
Table 501

PFCS ROLL AXIS MONITORING CHECK

TEST	ACTION	CHECK
8.	Turn on hydraulic systems A, B and C (Ref. 29-11-00); STAB INOP A, B, and C legends go off.	

AFCS Operation - General Test
Table 501

ELECTRICAL PITCH TRIM CHECK

TEST	ACTION	CHECK
1.	On FCES panel: set PITCH TRIM 1 switchlight to on (dark), and set PITCH TRIM 2 switchlight to OFF.	
2.	On Capt control wheel: turn pitch trim wheel in a pitch up direction.	Verify control column displacement by observing manual pitch trim wheel movement on center pedestal in a pitch up direction. Note the rate of manual pitch trim wheel movement.
3.	On FCES panel: set PITCH TRIM 2 switchlight to on (dark).	
4.	On F/O control wheel: turn pitch trim wheel in a pitch down direction.	Verify control column displacement by observing manual pitch trim wheel movement in a pitch down direction. Rate of manual pitch trim wheel motion should be approximately twice as fast with both switchlights on (dark) as was observed in Step 2.

AFCS Operation - General Test
Table 501

DLC/AGS CHECK

TEST	ACTION	CHECK
	WARNING: ENSURE THAT TRAVEL AREAS OF SLAT, FLAP, AND SPOILER SURFACES, AND THRUST REVERSERS ON EACH ENGINE, AND AUTOTHROTTLE CLUTCH ASSEMBLY AREA ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.	
1.	Ensure that flaps are 27 degrees or less.	
2.	On FCES panel: depress STALL WARN 1 and 2 switchlights to OFF.	
3.	On FCES panel: depress DLC/AUTO SPLR 1 switchlight to on (dark), and DLC/AUTO SPLR 2 switchlight to OFF.	DLC/AUTO SPLR 2 OFF light comes on.
4.	On pilots overhead panel: depress WARNING CAUTION ADVISORY TEST switch to ON, and then off.	Ensure that AUTO GND SPLRS INOP light is out within 15 seconds. If on, perform following steps to turn off the light: Ensure that hydraulic systems A, B, C and D are on. On FCES panel: cycle DLC/AUTO SPLR 1 and 2 switchlights to OFF, and then on. Then depress DLC/AUTO SPLR 2 switchlight to OFF.
5.	Set throttle levers to Idle or Reverse Thrust (RVS) as follows:	Check spoilers 1 through 4 for ground spoiler deployment as indicated on surface position indicator (SPI) and Speed Brake Lever (SPL) position:

AFCS Operation - General Test (Cont)
Table 501

DLC/AGS CHECK

TEST	ACTION			CHECK	
	No. 1	No. 2	No. 3	SPI	SPL
	RVS	Idle	Idle	No deploy	Zero
	RVS	RVS	Idle	Deploy	Max
	Idle	RVS	Idle	Retract	Zero
	Idle	RVS	RVS	Deploy	Max
	Idle	Idle	RVS	Retract	Zero
	RVS	Idle	RVS	Deploy	Max
	Idle	Idle	Idle	Retract	Zero

6.	Extend flaps more than 30 degrees.	On SPI: ground spoilers 1 thru 4 deployment is indicated. Speed brake lever moves to maximum position.
7.	Return flaps to less than 30 degrees.	On SPI: spoiler retraction is indicated. Speed brake lever moves to zero.
8.	Simulate airborne condition by removing AFCS/MLG accessory unit.	AUTO GND SPLRS INOP light comes on.
9.	Extend flaps more than 30 degrees.	Spoilers 1 through 4 slowly deploy to DLC neutral (-7 degrees).

NOTE: DLC NEUTRAL is defined as the aft edge of the speedbrake lever in approximately center of DLC RANGE marking. (See 27-61-00 for spoiler angles.)

10.	Move either control column as follows:	Check speedbrake lever movement as follows:

AFCS Operation - General Test (Cont)
Table 501

DLC/AGS CHECK

TEST	ACTION	CHECK
CR CR CR	Full forward	Spoilers move to DLC maximum, then DLC neutral after a short period of time.
CR CR	Center	Spoilers move to DLC zero, then DLC neutral after a short period of time.
CR CR	Full aft	Spoilers move to DLC zero, then DLC neutral after a short period of time.
CR CR CR	Center	Spoilers move to DLC maximum, then DLC neutral after a short period of time.
	11. Set throttle levers to Idle or Full Forward (FWD) as follows:	Check spoilers 1 through 4 for DLC operation as indicated on SPI and Speedbrake Lever position:

No. 1	No. 2	No. 3	SPI and Speedbrake Lever
FWD	Idle	Idle	DLC neutral
FWD	FWD	Idle	Retract
Idle	FWD	Idle	DLC neutral
Idle	FWD	FWD	Retract
Idle	Idle	FWD	DLC neutral
FWD	Idle	FWD	Retract
Idle	Idle	Idle	DLC neutral

12.	Depress DLC/AUTO SPLR 1 switchlight to OFF.
13.	Manually set speedbrake lever to zero.

AFCS Operation - General Test (Cont)
Table 501

DLC/AGS CHECK

TEST	ACTION	CHECK
14.	Install AFCS/MLG accessory unit.	
15.	Retract flaps to 27 degrees or less.	
16.	Depress DLC/AUTO SPLR 2 switchlight to on (dark).	AUTO GND SPLRS INOP light goes out.

NOTE: When checking channel 1, spoilers 1, 2, 3, 4 L and R fully deploy and speed brake handle travels full stroke.

When checking channel 2, spoilers 2, 3, 4 L and R fully deploy. Spoilers 1 L and R deploy approximately 50 degrees and speed brake handle travels approximately 1 to 1.5 inches less than full stroke.

Rate of speed brake handle travel at start of movement under both conditions is approximately the same. Channel 2 handle travel rate is slower during the last portion of handle motion.

17.	Set throttle levers to Idle or Reverse Thrust (RVS) as follows:			Check spoilers 1 through 4 for ground spoiler deployment as indicated by SPI and Speed Brake Lever (SPL) position.	
	No. 1	No. 2	No. 3	SPI	SPL
	RVS	Idle	Idle	No deploy	Zero
	REV	RVS	Idle	Deploy	Max
	Idle	RVS	Idle	Retract	Zero
	Idle	RVS	RVS	Deploy	Max
	Idle	Idle	RVS	Retract	Zero

AFCS Operation - General Test (Cont)
Table 501

DLC/AGS CHECK

TEST	ACTION	CHECK
	RVS Idle RVS	Deploy Max
	Idle Idle Idle	Retract Zero
18.	Extend flaps more than 30 degrees.	On SPI: ground spoilers 1 thru 4 deployment is indicated. Speed brake lever moves to maximum position.
19.	Return flaps to less than 30 degrees.	On SPI: spoiler retraction is indicated. Speed brake lever moves to zero.
20.	Simulate airborne condition by removing AFCS/MLG accessory unit.	AUTO GND SPLRS INOP light comes on.
21.	Extend flaps more than 30 degrees.	Spoilers 1 through 4 slowly deploy to DLC NEUTRAL (-7 degrees).
22.	Move either control column as follows:	Check speedbrake lever movement as follows:
CR CR CR	Full forward	Spoilers move to DLC maximum, then DLC neutral after a short period of time.
CR CR	Center	Spoilers move to DLC zero, then DLC neutral after a short period of time.
CR CR	Full aft	Spoilers move to DLC zero, then DLC after a short period of time.

AFCS Operation - General Test (Cont)
Table 501

DLC/AGS CHECK

TEST	ACTION	CHECK
CR CR CR	Center	Spoilers move to DLC maximum, then DLC neutral after a short period of time.
23.	Set throttle levers to Idle or Full Forward (FWD) as follows:	Check spoilers 1 through 4 for DLC operation as indicated on SPI and Speedbrake Lever position:

No. 1	No. 2	No. 3	SPI and Speedbrake Lever
FWD	Idle	Idle	DLC neutral
FWD	FWD	Idle	Retract
Idle	FWD	Idle	DLC neutral
Idle	FWD	FWD	Retract
Idle	Idle	FWD	DLC neutral
FWD	Idle	FWD	Retract
Idle	Idle	Idle	DLC neutral

24.	Depress DLC/AUTO SPLR 2 switchlight to OFF.	
25.	Manually set speedbrake lever to zero.	
26.	Install AFCS/MLG accessory unit.	
27.	Retract flaps to 27 degrees or less.	
28.	Depress DLC/AUTO SPLR 1 and 2 switchlights to on (dark).	AUTO GND SPLRS INOP light goes out.

AFCS Operation - General Test (Cont)
Table 501

DLC/AGS CHECK

TEST	ACTION	CHECK
29.	On CB1: close following circuit breakers: THRUST REVERSE ENG 1 (H16) ENG 2 (H17) ENG 3 (H18)	

AFCS Operation - General Test
Table 501

SPEED CONTROL CHECK

TEST	ACTION	CHECK
1.	Simulate airborne condition by removing AFCS/MLG accessory unit.	
2.	On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.	
3.	Ensure that flaps are less than 30 degrees.	
4.	On APFDS ENGAGE panel: set FD A and FD B switches to ON.	On both ADI: command bars come into view and are level.
5.	On FCES panel: set ATS switchlights 1 and 2 to on (dark).	
6.	On THRUST panel: set IAS knob to 100 knots.	

WARNING: ENSURE THAT AUTOTHROTTLE CLUTCH ASSEMBLY AREA IS CLEAR OF PERSONNEL AND EQUIPMENT.

7.	Set all throttle levers to mid-position.	

AFCS Operation - General Test (Cont)
Table 501

SPEED CONTROL CHECK		
TEST	ACTION	CHECK
8.	On THRUST panel: set ATS switch to ON.	ATS switch remains in ON position. All throttle levers drive forward until all levers hit the maximum thrust limit and hunt. On both ADI: FAST/SLOW displays indicate SLOW.
9.	Depress left autothrottle disengage switch.	On both AFCS WARNING indicators: flashing ALERT and ATS DISC messages are displayed.
10.	Depress left autothrottle disengage switch to turn off AFCS WARNING indicator messages.	
11.	On FCES panel: set ATS switchlights 1 and 2 to OFF.	
12.	Install AFCS/MLG accessory unit.	
13.	On APFDS ENGAGE panel: set FD A and FD B switches to OFF.	
14.	On CB1, close D4 and D22 circuit breakers.	

AFCS Operation - General Test
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
	WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.	
1.	On APFDS ENGAGE panel: set both FD switches to ON, and set AP A switch to CWS.	On both ADI: command bars are centered and level.
2.	Push Capt control column forward and turn control wheel to right and hold until Step 3.	Verify that control surfaces follow.
3.	Set AP A switch to OFF. Release control wheel. Set AP B switch to CWS.	On both AFCS WARNING indicators: AP DISC and flashing ALERT displays come on when AP A switch is set to OFF, and go out when AP B switch is set to CWS.
4.	Push F/O control column forward and turn control wheel to right and hold until Step 5.	Verify that control surfaces follow.
5.	Set AP B switch to OFF. Release control wheel. Set AP A switch to CMD.	On both AFCS WARNING indicators: AP DISC and flashing ALERT displays come on when AP B switch is set to OFF, and go out when AP A switch is set to CMD.
6.	On HEADING/PITCH MODE panel: depress VS switchlight to turn on VS light; and rotate thumbwheel for a VERT SPEED indication of +500 FPM (blue background).	On both AFCS MODES annunciators: VS messages are displayed.
		On both ADI: command bars move up.

AFCS Operation - General Test (Cont)
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
7.	On HEADING/PITCH MODE panel: depress ALT switchlight to turn on ALT light.	VS light goes out. On both AFCS MODES annunciators: VS messages are removed and ALT messages are displayed. On both ADI: command bars are centered and level.
8.	On HEADING/PITCH MODE panel: depress IAS switchlight to turn on IAS light.	ALT light goes out. On both AFCS MODES annunciators: ALT messages are removed and IAS messages are displayed. On both ADI: command bars are centered and level.
9.	On HEADING/PITCH MODE panel: depress MACH switchlight to turn on MACH light.	On HEADING/PITCH MODE panel: IAS light goes out. On both AFCS MODES annunciators: IAS messages are removed and MACH messages are displayed. On both ADI: command bars are centered and level.
R 10. R	Depress MACH switchlight to off (dark).	On both AFCS MODES annunciators: all messages are removed.

AFCS Operation - General Test (Cont)
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
11.	On HEADING/PITCH MODE panel: depress HDG switchlight to turn on HDG light.	On both AFCS MODES annunciators: HDG SEL messages are displayed. On both ADI: command bars are centered and level.
12.	Depress HDG switchlight to off (dark).	On both AFCS MODES annunciators: all messages are removed.
13.	Set VOR systems 1 and 2 to a frequency of 108.0 MHz (Ref. 34-55-00).	
14.	On NAV MODE panel: depress NAV switchlight to turn on NAV light.	On both AFCS MODES annunciators: VOR ARM messages are displayed. On both ADI: command bars are centered and level.
15.	Depress NAV switchlight to off (dark).	On both AFCS MODES annunciators: all messages are removed.
16.	Set ILS systems 1 and 2 to a frequency of 108.1 MHz (Ref. 34-33-00).	
17.	On NAV MODE panel: depress LOC light.	On both AFCS MODES annunciators: LOC ARM messages are displayed. On both ADI: command bars are centered and level.
18.	On NAV MODE panel: depress APR switchlight to turn on APR light.	On NAV MODE panel: LOC light goes out. On both AFCS MODES annunciators: LOC ARM and GS ARM messages are displayed.

AFCS Operation - General Test (Cont)
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
		On both ADI: command bars are centered and level. On both AFCS WARNING indicators: NO FLARE messages are displayed.
19.	On NAV MODE panel: depress A/L switchlight to turn on A/L light.	On NAV MODE panel: APR light goes out. On both AFCS MODES annunciators: A/L ARM, LOC ARM and GS ARM messages are displayed. On both ADI: command bars are centered and level.
20.	Depress A/L switchlight to off (dark).	On both AFCS MODES annunciators and both AFCS WARNING indicators: all messages are removed.
21.	On APFDS ENGAGE panel: depress TURB switchlight to turn on TURB light.	On APFDS ENGAGE panel: AP A switch drops to CWS. On both AFCS MODES annunciators: TURB messages are displayed. On both ADI: command bars are biased out-of-view.
22.	On Capt control wheel, depress AP disengage switch twice.	On APFDS ENGAGE panel: AP A switch drops to OFF. On both ADI: command bars are centered and level.
23.	Set AP B switch to CMD.	

AFCS Operation - General Test (Cont)
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
24.	Depress VS switchlight to turn on VS light; and rotate thumbwheel for a VERT SPEED indication of +500 FPM (blue background).	On both AFCS MODES annunciators: VS messages are displayed. On both ADI: command bars move up.
25.	Depress ALT switchlight to turn on ALT light.	VS light goes out. On both AFCS MODES annunciators: VS messages are removed and ALT messages are displayed. On both ADI: command bars are centered and level.
26.	Depress IAS switchlight to turn on IAS light.	ALT light goes out. On both AFCS MODES annunciators: ALT messages are removed and IAS messages are displayed. On both ADI: command bars are centered and level.
27.	On HEADING/PITCH MODE panel: depress MACH switchlight to turn on MACH light.	On HEADING/PITCH MODE panel: IAS light goes out. On both AFCS MODES annunciators: IAS messages are removed and MACH messages are displayed. On both ADI: command bars are centered and level.

AFCS Operation - General Test (Cont)
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
28.	Depress MACH switchlight to off (dark).	On both AFCS MODES annunciators: all messages are removed.
29.	Depress HDG switchlight to turn on HDG light.	On both AFCS MODES annunciators: HDG SEL messages are displayed. On both ADI: command bars are centered and level.
30.	Depress HDG switchlight to off (dark).	On both AFCS MODES annunciators: All messages are removed.
31.	Set VOR systems 1 and 2 to a frequency of 108.0 MHz (Ref. 34-55-00).	
32.	On NAV MODE panel: depress NAV switchlight to turn on NAV light.	On both AFCS MODES annunciators: VOR ARM messages are displayed. On both ADI: command bars are centered and level.
33.	Depress NAV switchlight to off (dark).	On both AFCS MODES annunciators: all messages are removed.
34.	Set ILS systems 1 and 2 to a frequency of 108.1 MHz (Ref. 34-33-00).	
35.	On NAV MODE panel: depress LOC switchlight to turn on LOC light.	On both AFCS MODES annunciators: LOC ARM messages are displayed. On both ADI: command bars are centered and level.

AFCS Operation - General Test (Cont)
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
36.	On NAV MODE panel: depress APR switchlight to turn on APR light.	On NAV MODE panel: LOC light goes out. On both AFCS MODES annunciators: LOC ARM and GS ARM messages are displayed. On both AFCS WARNING indicators: NO FLARE messages are displayed. On both ADI: command bars are centered and level.
37.	On NAV MODE panel: depress A/L switchlight to turn on A/L light.	On NAV MODE panel: APR light goes out. On both AFCS MODES annunciators: A/L ARM, LOC ARM and GS ARM messages are displayed. On both ADI: command bars are centered and level.
38.	Depress A/L switchlight to off (dark).	On both AFCS MODES annunciators and both AFCS WARNING indicators: all messages are removed.
39.	On APFDS ENGAGE panel, depress TURB switchlight to turn on TURB light.	On APFDS ENGAGE panel: AP B switch drops to CWS. On both AFCS MODES annunciators: TURB messages are displayed. On both ADI: command bars are biased out-of-view.

AFCS Operation - General Test (Cont)
Table 501

APFDS ENGAGE LOGIC CHECK

TEST	ACTION	CHECK
40.	On F/O control wheel, depress AP disengage switch twice.	On APFDS ENGAGE panel: AP B switch drops to OFF. On both ADI: command bars are centered and level.
41.	On F/O control wheel: depress TAKEOFF-GO/APOUND switch.	On both AFCS MODES annunciators: TAKEOFF messages are displayed. On both ADIs, command bars are in view.
	NOTE: Pitch command bar positioning is related to angle-of-attack probe positioning, and may command fly-up, be centered, or fly-down.	
42.	On APFDS ENGAGE panel: set both FD switches to OFF.	On both ADI: command bars are biased out-of-view. On both AFCS MODES annunciators all messages are removed.

AFCS Operation - General Test
Table 501

TEST COMPLETION

TEST	ACTION	CHECK
1.	.....	All autoflight computers: Verify that all computer FIM annunciators are black.
2.	.....	On FCES computer: verify that all FIM annunciators are black.
	NOTE: If test in Table 502 is to be performed, disregard test completion.	
3.	On pilots overhead circuit breaker panel CB1: remove tag and close MISC - RAT AUTO DEPLOY (L3) circuit breaker.	
4.	Remove RAT ground safety lock (Ref. 29-21-00).	
5.	Turn off hydraulic power (Ref. 29-11-00).	
6.	Turn off electrical power (24-00-00).	

5. DANA/NO DUAL Test

A. General

This procedure (Ref. Table 502) is used to check for a system fault which results in a display of a DUAL A/I NOT AVAIL (DANA) advisory message and/or a NO DUAL warning message.

If a fault cannot be confirmed by the test, the extended DANA/NO DUAL test specified in Paragraph 6 should be performed to check for an electromechanical sensor fault which may not be apparent during static ground checks.

NOTE: 1. CONTROL SURFACE DRIFT. During ground tests with the AUTOLAND mode engaged, the airplane control surfaces may drift to full deflection although system input command signals are apparently at zero. This operation is normal, and is the result of the integration of small error signals in the system which are not compensated for by airplane response to control surface position. Over a relatively long time period (1 minute or more), differences between the integrated signals may result in a fault indication. To avoid nuisance indications of this type during the performance of an AUTOLAND test, the pace of testing should be steady and even, and long time intervals between successive stops of a test should be avoided.

B. Dual Radio Altitude Simulator Cable Assy

Either a passive or an active cable assy, described in GITEL 34-32-01, may be used to slave both radio altimeter systems.

CAUTION: IF THE PASSIVE CABLE IS USED, BOTH RADIO ALTIMETER ANTENNAS MAY HAVE TO BE COVERED WITH FOIL TO PRECLUDE RF INTERACTION BETWEEN SYSTEMS. IF FOIL OR SUITABLE SUBSTITUTE IS USED TO COVER THE ANTENNAS, A "REMOVE BEFORE FLIGHT" STREAMER MUST BE UTILIZED.

DANA/NO DUAL Test
Table 502

SET UP	ACTION	CHECK
	WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.	
1.	Turn on electrical power (Ref. 24-00-00).	
2.	.....	Avionics cooling is on (Ref. 21-00-00).
	WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM. LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED. TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT. THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.	
3.	Turn on hydraulic systems A and B (Ref. 29-11-00).	
	NOTE: The Air Turbine Motor (ATM) must be selected to the ON position. Selection of AUTO can create ground test problems.	
4.	.....	Verify that the following systems are on: Air data computer (Ref. 34-14-00) Attitude Reference System (Ref. 34-21-00) Magnetic Heading Reference System (Ref. 34-22-00) Radio Altimeter System (Ref. 34-32-00) Instrument Landing System (Ref. 34-33-00) Inertial Navigation System (Ref. 34-43-00)

DANA/NO DUAL Test (Cont)
Table 502

SET UP	ACTION	CHECK
5.	.....	On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed: AUTO THROT SERVO (A1) SPEED CONT (A2) (A20) YAW SAS (A5) (A23) PITCH & ROLL (A6) (A24) TRIM AGMT AC (A7) (A25) TRIM AGMT DC (A8) (A26) AFCS MODE IND (B1) (B19) FCES COMPUTERS DC (B4) FCES COMPUTERS AC&L AOA (B5) FCES STICK SHAKE (B6) SPOILER DWELL DC (B7) SPOILER DWELL AC (B8) NO. 1 AFT COUPLER (B9) NO. 2 AFT COUPLER (B27) ALT ALERT 1 (K27) ALT ALERT 2 (J21)
	.....	On Flight Engineers/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed: FLIGHT STATION MISC R AOA (F1) STICK SHAKE (F2) AFCS WARNING CAPT (K18) F/O (K19)

DANA/NO DUAL Test (Cont)
Table 502

SET UP	ACTION	CHECK
		On Flight Engineers/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed: IND LT PFCS ADS/DH (G8) FLT CONT ALT ALERT (G9)
	6. On CB1: open and tag MISC - RAT AUTO DEPLOY (L3) circuit breaker. On CB2: open and tag NOSE STEERING (F19) circuit breaker.	
	7. Install RAT ground safety lock (Ref. 29-21-00).	
	8.	All FIM annunciators are black, on all autoflight system computers.
	9. Set all throttles to idle.	
	10. Set flaps to 22 degrees and then to 33 degrees.	
	11. On FCES panel: depress STALL WARN 1 and 2 switchlights to OFF.	
	12.	Ensure that both HSI compass cards indicate same aircraft heading. Compass cards must agree, to within 6 degrees of each other.

DANA/NO DUAL Test (Cont)
Table 502

SET UP	ACTION	CHECK
	NOTE: The local magnetic environment may cause disagreement between the HSI indications of more than 6 degrees. In this event both compass system must be switched to the DG mode. Under these conditions, the alignment between the compass systems must be checked prior to preforming any test which requires engagement of the AUTOLAND mode. A difference, between systems, of more than 6 degrees will cause a display of the NO ALIGN message on the AFCS WARNING indicators.	
13.	On NAV MODE panel: set both COURSE knobs to aircraft heading.	
14.	On HEADING/PITCH MODE panel: set HEADING knob to aircraft heading.	
15.	Set both VHF NAV frequency selectors to 108.1 MHz.	
16.	Position VOR/ILS ramp test set T-30 in cockpit and turn on LOC and GS POWER switches. Set LOC and GS selectors to VARIABLE and establish zero LOC and GS beam deviation on both HSI.	
17.	On ramp test set, set LOC and GS POWER switches to OFF. (Turn on LOC and GS POWER switches as required during test to preserve batteries.	

DANA/NO DUAL Test (Cont)
Table 502

SET UP	ACTION	CHECK
18.	.....	On PFCS Monitor panel: ensure the RUDDER switch and L INBD AILERON switches are set to on, and that all STABILIZER switches are on.
19.	.....	On APFDS ENGAGE panel: ensure that AP engage and FD switches are set to OFF.
20.	On pilots overhead circuit breaker panel CB1: open RADIO ALTM (D4) and (D22) circuit breakers.	
21.	On radio altimeter test set 980N-1: set TEST SELECT switch to OFF.	
22.	In mid electrical service center: connect radio altimeter test set with dual radio cable assembly (G/ITEL No. 34-32-01) to TEST connectors on front of radio altimeter RT No. 1 and 2.	
23.	On CB1: close circuit breakers D4 and D22.	
24.	.....	On both Rad. Alt. Indicators: with Captains radio height set to zero feet, verify flags are not displayed and altitude indications agree to within 6 feet.

DANA/NO DUAL Test (Cont)
Table 502

SET UP	ACTION	CHECK
25.	.....	On Caution and Warning Panel: verify VERTICAL GYRO 3 and DUAL A/L NOT AVAIL legends are not displayed.
26.	.....	On both INSTR COMPARATOR indicators: verify cautionary messages not displayed.
27.	.....	On both ADI: verify FD and ATT flags are not displayed, and flight director command bars are not in view.
28.	.....	On Capt and F/O ADI: verify artificial horizon positions agree, within 2.5 degrees, in pitch and roll.
29.	On Capt INSTR SOURCE SELECT panel: depress ATT switchlight to ALTN.	Verify Capt and F/O ADI horizon positions agree within 2.5 degrees.
30.	Depress Capt ATT switchlight to off (dark).	
31.	Using radio altimeter test set: establish a simulated altitude of 2000 ft. as indicated on the instrument panel radio altitude indicators.	
32.	On FCES panel: depress YAW SAS 1 and 2 switchlights to OFF, and depress PITCH TRIM 1 and 2 switchlights to OFF.	

DANA/NO DUAL Test (Cont)
Table 502

SET UP	ACTION	CHECK
33.	On center console: set manual PITCH TRIM WHEEL to an index of approximately 5.5 (this position and the corresponding control column position will be called neutral position for this test).	
34.	On center console: turn manual ROLL TRIM WHEEL to an index of 0.	
35.	On FCES panel: depress PITCH TRIM 1 and 2 and YAW SAS 1 and 2 switchlights to on (dark).	
36.	On APFDS ENGAGE panel: set both FD switches to ON.	On both ADI: FD flags are out-of-view, and command bars are centered and level.
37.	On CB1: open then close both PITCH & ROLL (A6 and A24) circuit breakers.	

CAUTION: ENSURE THAT ALL OBSTRUCTIONS ARE CLEAR OF THE AIRCRAFT.

NOTE: During the following tests, the rudder should not be allowed to reach the limits of its travel, either due to drift or prolonged application of a command signal. This condition can cause an unbalance between the computation circuits, resulting in a nuisance DANA annunciation.

To reset a DANA which appears below 1500 ft., the flight directors should be turned off prior to recycling circuit breakers A6 and A24. Failure to take this action will cause the DANA to set in the yaw channel.

DANA/NO DUAL Test
Table 502

TEST	ACTION	CHECK
	RUNDOWN CHECK	
1.	Switch on ILS Test Set and adjust 'localizer' and glideslope controls to establish zero deviation on HSI.	
2.	On APFDS ENGAGE Panel: set AP A switch to CMD.	On Caution and Warning Panel (CAWP): DANA legend is not illuminated.
3.	On NAV MODE Select panel: depress A/L switchlight to turn on A/L light.	DANA legend is not illuminated. On both AFCS MODES annunciators: LOC ARM, GS ARM and A/L ARM messages are displayed.
4.	On the APFDS ENGAGE panel: set AP B switch to CMD.	DANA legend is not illuminated. On AFCS MODES annunciators: LOC and GS messages are displayed.
5.	On radio altimeter test set: reduce radio altitude to 1000 ft.	After approximately 35 seconds: On CAWP: DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. On AFCS MODES annunciators: A/L, ALN ARM and FLR ARM messages are displayed.

DANA/NO DUAL Test (Cont)
Table 502

TEST	ACTION	CHECK
6.	On ILS Test Set: slowly vary the localizer signal from zero to +1 bar width to -1 bar width and back to zero, over a period of between 10 to 15 seconds.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed.
	NOTE: One-bar width equals left side of bar aligned with right side of pointer.	
7.	On ILS Test Set: slowly vary the glideslope signal from zero to ±1 dot to -1 dot and back to zero, over a period of 20 seconds.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed.
8.	On radio altimeter test set: reduce radio altitude height to 130 ft.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. On AFCS MODES annunciators: ALIGN and FLR ARM messages are displayed.
9.	On ILS Test Set: vary localizer signal from zero to ±1 bar width, to -1 bar width, to zero within a 10 to 15 sec. period. Complete 2-cycles.	Monitor rudder position to ensure that it does not reach its limit. DANA legend is not illuminated.
10.	On ILS Test Set: vary glideslope signal from zero to ±1/2 dot, to -1/2 dot, to zero over a 15 sec.	DANA legend is not illuminated.

DANA/NO DUAL Test (Cont)
Table 502

TEST	ACTION	CHECK
11.	Simulate 'airborne' condition by either removing the AFCS/MLG ACCESSORY UNIT or by opening circuit breaker L8 or F16 on panel CB2.	
	NOTE: It is not necessary to monitor pitch trim wheel rotation.	
12.	On radio altimeter test set: reduce radio altitude height to zero, over a 10 sec. period.	DANA legend is not illuminated. On AFCS MODES annunciators: FLARE and ROLLOUT messages are displayed.
	NOTE: Do not decrease height below zero feet as this can cause a fail on the test set.	
13.	On APFDS ENGAGE panel: set both FD switches to OFF.	
14.	On either control wheel: disengage autopilot by depressing the AP DISC switch.	DANA legend is not illuminated.
	NOSE UP TRIM BIAS CHECK	
15.	On radio altimeter test set: increase radio altitude height to 1600 ft.	
16.	On APFDS ENGAGE and NAV MODE panels: set AP A switch to CMD, depress A/L switchlight, set AP B switch to CMD, wait 35 seconds.	On AFCS MODES annunciators: LOC, GS and A/L ARM messages are displayed.

DANA/NO DUAL Test (Cont)
Table 502

TEST	ACTION	CHECK
	NOTE: During this period the trim wheel drift should be backed off with the glideslope signal. The trim wheel should be stationary before proceeding.	
17.	On radio altimeter test set: reduce radio altitude to 1400 ft.	On AFCS MODES annunciators: A/L messages are displayed. Trim wheel runs nose up.
18.	Revert to "on ground" condition by reversing ACTION taken in TEST 11. PITCH DANA LOGIC CHECK	
19.	On FCES panel: depress both PITCH TRIM switchlights to OFF.	DANA legend displayed. On AFCS WARNING indicators: NO DUAL messages are displayed.
20.	On control wheel: depress AP DISC switch. On FCES panel: depress both PITCH TRIM switchlights to ON.	
21.	On CB1, open and close PITCH AND ROLL (A24) circuit breaker.	DANA legend still displayed.
22.	On CB1, open and close PITCH AND ROLL (A6) circuit breaker.	DANA legend becomes extinguished.
23.	On APFDS Engage and NAV MODE panels: set AP A switch to CMD, depress A/L switchlight, set AP B switch to CMD, wait 35 seconds.	On AFCS MODES annunciators: LOC, GS and A/L messages are displayed.

DANA/NO DUAL Test (Cont)
Table 502

TEST	ACTION	CHECK
24.	On FCES panel: depress both PITCH TRIM switchlights to OFF.	DANA legend displayed. On AFCS WARNING indicators: NO DUAL messages are displayed.
25.	On control wheel: depress AP DISC switch. On FCES panel: depress both PITCH TRIM switchlights to ON.	
26.	Open and close PITCH AND ROLL (A6) circuit breaker.	DANA legend displayed.
27.	Open and close PITCH AND ROLL (A24) circuit breaker.	DANA legend becomes extinguished.
	YAW DANA LOGIC CHECK	
28.	On APFDS ENGAGE and NAV MODE panels: set AP A switch to CMD, depress A/L switchlight, set AP B switch to CMD, wait 35 seconds.	On AFCS MODES annunciators: LOC, GS and A/L messages are displayed.
29.	On CB2, open and close R AOA (F1) circuit breaker.	DANA legend displayed. On AFCS WARNING indicators: NO DUAL messages are displayed.
30.	On control wheel: depress AP DISC switch.	
31.	On CB1, open PITCH AND ROLL (A24) circuit breaker.	DANA legend still displayed.
32.	On CB1, open and close PITCH AND ROLL (A6) circuit breaker.	DANA legend becomes extinguished.

DANA/NO DUAL Test (Cont)
Table 502

TEST	ACTION	CHECK
33.	On CB1, close PITCH AND ROLL (A24) circuit breaker	
34.	On FCES panel: depress both YAW SAS switchlights to OFF. Wait 60 sec., then depress both yaw SAS switchlights to on (dark).	
35.	On APFDS ENGAGE and NAV MODE Select Panels: set AP A switch to CMD, depress A/L switchlight, set AP B switch to CMD, wait 35 seconds.	On AFCS MODES annunciators: LOC, GS and A/L messages are displayed.
36.	On CB2, open and close circuit breaker R AOA (F1).	DANA legend displayed.
37.	On control wheel: depress AP DISC button.	
38.	Open PITCH AND ROLL (A6) circuit breaker.	DANA legend remains displayed.
39.	Open and close PITCH AND ROLL (A24) circuit breaker.	DANA legend is extinguished.
40.	Close PITCH AND ROLL (A6) circuit breaker.	
41.	On FCES panel: depress both YAW SAS switchlights to OFF.	
42.	Test completion: (a) Raise flaps to 0 degrees. (b) Move trim wheel fully nose down.	

DANA/NO DUAL Test (Cont)
Table 502

TEST	ACTION	CHECK
	(c) Disconnect test setup.	
	(d) Ensure radio altimeter fail flags are clear.	
	(e) On CB1: remove tag and close MISC-RAT AUTO DEPLOY (L3) circuit breaker.	
	(f) Remove RAT ground safety lock (Ref. 29-21-00).	
	(g) Turn off hydraulic power (Ref. 29-11-00).	
	(h) Turn off electrical power (Ref. 24-00-00)	
	(j) Reset FIM or radio altimeter RT's if tripped.	
	(k) Ensure AFCS/MLG ACCESSORY UNIT is fitted.	
	(l) Ensure circuit breakers are closed.	

6. Extended DANA/NO DUAL Test

A. General

This procedure (Ref. Table 503) defines the tests which should be performed if the DANA/NO DUAL test specified in Paragraph 5 can be successfully completed (fault not confirmed) after a pilot report of a "DUAL A/L NOT AVAIL" (DANA) and/or NO DUAL annunciation. Its purpose is to check the operation of electromechanical sensors (gyros and accelerometers) and that portion of the fault isolation monitoring (FIM) system which will ordinarily detect and indicate a faulted sensor.

Extended DANA/NO DUAL Test
Table 503

SET UP	ACTION	CHECK
		SET UP
	WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.	
1.	Turn on electrical power (Ref. 24-00-00).	
2.	.....	Avionics cooling is on (Ref. 21-00-00).
3.	On CB1: open and tag MISC - RAT AUTO DEPLOY (L3) circuit breaker. On CB2: open and tag NOSE STEERING (F19) circuit breaker.	
4.	Install RAT ground safety lock (Ref. 29-21-00).	
	WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM. LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED. TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT. THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.	
5.	Turn on hydraulic systems A and B (Ref. 29-11-00).	
	NOTE: The Air Turbine Motor (ATM) must be selected to the ON position. Selection of AUTO can create ground test problems.	

Extended DANA/NO DUAL Test (Cont)
Table 503

SET UP	ACTION	CHECK
		SET UP
6.	.....	Verify that the following systems are on: Air data computer (Ref. 34-14-00) Attitude Reference System (Ref. 34-21-00) Magnetic Heading Reference System (Ref. 34-22-00) Radio Altimeter System (Ref. 34-32-00) Instrument Landing System (Ref. 34-33-00) Inertial Navigation System (Ref. 34-43-00)
7.	.....	On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed: AUTO THROT SERVO (A1) SPEED CONT (A2) (A20) YAW SAS (A5) (A23) PITCH & ROLL (A6) (A24) TRIM AGMT AC (A7) (A25) TRIM AGMT DC (A8) (A26) AFCS MODE IND (B1) (B19) FCES COMPUTERS DC (B4) FCES COMPUTERS AC&L AOA (B5) FCES STICK SHAKE (B6) SPOILER DWELL DC (B7) SPOILER DWELL AC (B8) NO. 1 AFT COUPLER (B9) NO. 2 AFT COUPLER (B27) ALT ALERT 1 (K27) ALT ALERT 2 (J21)

Extended DANA/NO DUAL Test (Cont)
Table 503

SET UP	ACTION	CHECK
		SET UP
	.....	On Flight Engineers/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed: FLIGHT STATION MISC R AOA (F1) STICK SHAKE (F2) AFCS WARNING CAPT (K18) F/O (K19) On Flight Engineers/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed: IND LT PFCS ADS/DH (G8) FLT CONT ALT ALERT (G9)
8.	.....	All FIM annunciators are black on all autoflight system computers.
9.	Set all throttles to idle.	
10.	If flaps are retracted, set to 33 degrees. If flaps are extended, set flaps to 22 degrees, and then to 33 degrees	
11.	On FCES panel: depress STALL WARN 1 and 2 switchlights to OFF.	

Extended DANA/NO DUAL Test (Cont)
Table 503

SET UP	ACTION	CHECK
	SET UP	
12.	Ensure that both HSI compass cards indicate same aircraft heading. Compass cards must agree, to within 6 degrees of each other. NOTE: The local magnetic environment may cause disagreement between the HSI indications. In this event both compass systems must be switched to the DG mode. Under these conditions, the alignment between the compass systems must be checked prior to preforming any test which requires engagement of the AUTOLAND mode. A difference, between systems, of more than 6 degrees will cause a display of the NO ALIGN message on the AFCS WARNING indicators.	
13.	On NAV MODE panel: set both COURSE knobs to aircraft heading.	
14.	On HEADING/PITCH MODE panel: set HEADING knob to aircraft heading.	
15.	Set both VHF NAV frequency selectors to 108.1 MHz.	
16.	Position VOR/ILS ramp test set in cockpit and turn on LOC and GS POWER switches. Set LOC and GS selectors to VARIABLE and establish zero LOC and GS beam deviation on both HSI.	

Extended DANA/NO DUAL Test (Cont)
Table 503

SET UP	ACTION	CHECK
	SET UP	
17.	On ramp test set, set LOC and GS POWER switches to OFF. (Turn on LOC and GS POWER switches as required during test to preserve batteries.	
18.	On PFCS Monitor panel: ensure the RUDDER switch and L INBD and R INBD AILERON switches are set to on, and that all STABILIZER switches are on.	
19.	On FCES panel: depress YAW SAS 1 and 2 switchlights to OFF, and depress PITCH TRIM 1 and 2 switchlights to OFF.	
20.	On center console: set manual PITCH TRIM WHEEL to an index of approximately 5.5. (This position and the corresponding control column position will be called neutral position for this test.)	
21.	On center console: turn manual ROLL TRIM WHEEL to an index of 0.	
22.	On FCES panel: depress PITCH TRIM 1 and 2 and YAW SAS 1 and 2 switchlights to on (dark).	
23.	On APFDS ENGAGE panel: set both FD switches to ON.	On both ADI: FD flags are out-of-view, and command bars are centered and level.

Extended DANA/NO DUAL Test (Cont)
Table 503

SET UP	ACTION	CHECK
	SET UP	
24.	Set both FD switches to OFF.	
25.	On CB1: open then close both PITCH & ROLL (A6 and A24) circuit breakers.	
26.	On Flight Engineers/Second Officers circuit breaker panel CB2: open MLG GND SENSE (L8) and TRUCK LEVEL (F16) circuit breakers. (This simulates aircraft being in-flight condition. This can also be simulated by removing AFCS/MLG accessory unit from FCES center rack.)	
	CAUTION: ENSURE THAT ALL OBSTRUCTIONS ARE CLEAR OF THE AIRCRAFT. VIOLENT OSCILLATIONS MAY BE SET UP DURING THE SUBSEQUENT TESTS.	
	NOTE: During the following tests the control surfaces should not be allowed to reach the limit of their travel, nor should the AP LIMIT warning appear for extended periods. Either of these conditions can cause the subchannel computations to saturate resulting in a DANA warning.	
27.	On pilots overhead circuit breaker panel CB1, zone 21C, open following circuit breakers: INS-3/GYRO-3 (E24) VG/INS-1 (G6) INS/VERT GYRO (G24)	

Extended DANA/NO DUAL Test (Cont)
Table 503

SET UP	ACTION	CHECK
	SET UP	
28.	On attitude system tester: set VG1, VG2 and VG3 switches to OFF, and set VALIDITY switches to ALL.	
29.	Connect attitude system tester, G/ITEL 34-21-77, to vertical gyro No. 1, No. 2 and No. 3.	
30.	Close circuit breakers opened in Step 27.	
31.		On both Rad. Alt. Indicators: verify flags are not displayed and altitude indications agree, to within 6 feet, at a nominal altitude of zero feet.
32.		On Caution and Warning Panel: verify VERTICAL GYRO 3 and DUAL A/L NOT AVAIL legends are not displayed.
33.		On INSTR COMPARATOR indicator: verify cautionary messages not displayed.
34.		On both ADI: verify FD and ATT flags are not displayed, and flight director command bars are not in view.
35.		On Capt and F/O ADI: verify artificial horizon positions agree, within 2.5 degrees, in pitch and roll.

Extended DANA/NO DUAL Test (Cont)
Table 503

SET UP

SET UP	ACTION	CHECK
36.	On Capt INSTR SOURCE SELECT panel: depress ATT switchlight to ALTN.	Verify Capt and F/O ADI horizon positions agree within 2.5 degrees.
37.	Depress Capt ATT switchlight to off (dark).	
38.	On FCES Computers verify that the following FIM annunciators are black: ATTITUDE GYROS YAW RATE GYRO 1 YAW RATE GYRO 2 YAW RATE GYRO 3 LATERAL ACCEL NORMAL ACCEL	

Extended DANA/NO DUAL Test
Table 503

NORMAL ACCELEROMETER CHECK

TEST	ACTION	CHECK
1.	On galley ceiling zone 135: carefully remove normal accelerometer unit and tilt approximately 90 degrees in nose-up direction. Hold in this position through following steps. Do not let it dangle by its cables.	
2.	On APFDS ENGAGE panel: set AP A switch to CMD.	On caution and warning panel (CAWP): DANA legend extinguished.
3.	On NAV MODE panel: depress A/L switchlight.	DANA legend extinguished. On AFCS MODES annunciators: LOC ARM, GS ARM and A/L ARM messages are displayed.
4.	On APFDS ENGAGE panel: set AP B switch to CMD.	DANA legend extinguished.

WARNING: DURING THE FOLLOWING TESTS THE CONTROL COLUMNS AND WHEELS WILL MOVE. STAY CLEAR OF THESE CONTROLS AT ALL TIMES.

Extended DANA/NO DUAL Test (Cont)
Table 503

NORMAL ACCELEROMETER CHECK

TEST	ACTION	CHECK
5.	Switch on ILS test set and adjust 'localizer' and glideslope controls to establish zero deviation on HSI.	DANA legend extinguished. On AFCS MODES annunciators: LOC and GS messages are displayed. On AFCS MODES indicators: A/L, ALIGN, FLARE and ROLLOUT are displayed in approximately 35 seconds. On AFCS WARNING indicators: display of AP LIMIT message may be ignored. On FCES computer: NORMAL ACCEL FIM indicator shows black.
	NOTE: Trim wheel drift should be backed off with a glideslope signal.	
6.	On either control wheel: momentarily depress AP DISC switch.	Both AP engage switches drop to OFF. On both AFCS MODES annunciators: all messages are removed. On both AFCS WARNING indicators: AP DISC messages are displayed.
7.	Switch off ILS test set.	
8.	On CB1: open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker.	
9.	Set FD A switch to ON.	On Capt ADI: command bar comes into view and is centered and level.

Extended DANA/NO DUAL Test (Cont)
Table 503

NORMAL ACCELEROMETER CHECK		
TEST	ACTION	CHECK
10.	Carefully disconnect normal accelerometer No. 3 cable.	On FCES computer: NORMAL ACCEL FIM indicator shows yellow.
11.	Connect normal accelerometer No. 3 cable.	
12.	On FCES computer: depress RESET switch.	On FCES computer: NORMAL ACCEL FIM shows black.
13.	Set FD A switch to OFF.	On Capt ADI: command bars are biased out-of-view.
14.	On CB1: open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker and close A24 circuit breaker.	
15.	Set FD B switch to ON.	On F/O ADI: command bar comes into view and is centered and level.
16.	Carefully disconnect normal accelerometer No. 3 cable.	On FCES computer: NORMAL ACCEL FIM indicator shows yellow.
17.	Connect normal accelerometer No. 3 cable and install accelerometer unit securely.	
18.	On FCES computer: depress RESET switch.	On FCES computer: NORMAL ACCEL FIM shows black.
19.	Set FD B switch to OFF.	On F/O ADI: command bar biased out-of-view.
20.	On CB1: close A6 circuit breaker.	

Extended DANA/NO DUAL Test
Table 503

LATERAL ACCELEROMETER CHECK

TEST	ACTION	CHECK
1.	On galley ceiling, zone 135: carefully remove and tilt lateral accelerometer unit clockwise about roll axis (right wing down direction) approximately 90 degrees. Keep unit in this position throughout the following series of tests. Avoid moving unit suddenly. Do not let it dangle by its cables.	
2.	On APFDS ENGAGE panel: set AP A switch to CMD.	DANA legend extinguished.
3.	On NAV MODE panel: depress A/L switchlight to turn on A/L light.	On CAWP: DANA legend extinguished. On AFCS MODES annunciators: LOC ARM, GS ARM and A/L ARM messages are displayed.
4.	On APFDS ENGAGE panel: set AP B switch to CMD.	DANA legend extinguished.

WARNING: DURING THE FOLLOWING TESTS THE CONTROL COLUMN AND WHEELS WILL MOVE. STAY CLEAR OF THESE CONTROLS AT ALL TIMES.

Extended DANA/NO DUAL Test (Cont)
Table 503

LATERAL ACCELEROMETER CHECK		
TEST	ACTION	CHECK
5.	Switch on ILS test set and adjust 'localizer' and glideslope controls to establish zero deviation on HSI.	DANA legend extinguished. On AFCS MODES annunciators: LOC and GS messages are displayed. On AFCS MODES indicators: A/L, ALIGN, FLARE and ROLLOUT are displayed in approximately 35 seconds. On AFCS WARNING indicators: Display of AP LIMIT message may be ignored. On FCES computer: LATERAL ACCEL FIM indicator shows black.
	NOTE: Trim wheel drift should be backed off with a glideslope signal.	
6.	On either control wheel: momentarily depress AP DISC switch.	Both AP engage switches drop to OFF. On both AFCS MODES annunciators: all messages are removed. On both AFCS WARNING indicators: AP DISC messages are displayed.

Extended DANA/NO DUAL Test (Cont)
Table 505

TEST	ACTION	CHECK
	LATERAL ACCELEROMETER CHECK	
7.	Tilt lateral accelerometer clockwise about roll axis approximately 180 degrees to left wing down 90 degree position. Keep unit in this position throughout the following series of tests. Avoid moving unit suddenly. Do not let it dangle by its cables.	
8.	On APFDS ENGAGE panel: set AP A switch to CMD.	DANA legend extinguished.
9.	On NAV MODE panel: depress A/L switchlight to turn on A/L light.	DANA legend extinguished. On AFCS MODES annunciators: LOC ARM, GS ARM and A/L ARM messages are displayed.
10.	On APFDS ENGAGE panel: set AP B switch to CMD.	DANA legend extinguished.

WARNING: DURING THE FOLLOWING TESTS THE CONTROL COLUMNS AND WHEELS WILL MOVE. STAY CLEAR OF THESE CONTROLS AT ALL TIMES.

Extended DANA/NO DUAL Test (Cont)
Table 503

TEST	ACTION	CHECK
	LATERAL ACCELEROMETER CHECK	
11.	On ILS test set, adjust 'localizer' and glideslope controls to establish zero deviation on HSI.	DANA legend extinguished. On AFCS MODES annunciators: LOC and GS messages are displayed. On AFCS MODES indicators: A/L, ALIGN, FLARE and ROLLOUT messages are displayed in approximately 35 seconds. On AFCS WARNING indicators: Display of AP LIMIT message may be ignored. On FCES computer: LATERAL ACCEL FIM indicator shows black.
	NOTE: Trim wheel drift should be backed off with a glide slope signal.	
12.	On either control wheel: momentarily depress AP DISC switch.	Both AP engage switches drop to OFF. On both AFCS MODES annunciators: all messages are removed. On both AFCS WARNING indicators: AP DISC messages are displayed.
13.	Switch off ILS test set.	
14.	On CB1: open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker.	

Extended DANA/NO DUAL Test (Cont)
Table 503

LATERAL ACCELEROMETER CHECK

TEST	ACTION	CHECK
15.	Set FD A switch to ON.	On Capt ADI: command bar comes into view and is centered and level.
16.	Carefully disconnect lateral accelerometer No. 3 cable.	On FCES computer: LATERAL ACCEL FIM indicator shows yellow.
17.	Connect lateral accelerometer No. 3 cable.	
18.	On FCES computer: depress RESET switch.	On FCES computer: LATERAL ACCEL FIM shows black.
19.	Set FD A switch to OFF.	On Capt ADI: command bars are biased out-of-view.
20.	On CB1: open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker and close A24 circuit breaker.	
21.	Set FD B switch to ON.	On F/O ADI: command bar comes into view and is centered and level.
22.	Carefully disconnect lateral accelerometer No. 3 cable.	On FCES computer: LATERAL ACCEL FIM indicator shows yellow.
23.	Connect lateral accelerometer No. 3 cable and install accelerometer unit securely.	
24.	On FCES computer: depress RESET switch.	On FCES computer: LATERAL ACCEL FIM shows black.
25.	Set FD B switch to OFF.	On F/O ADI: command bar biased out-of-view.
26.	On CB1: close A6 circuit breaker.	

Extended DANA/NO DUAL Test
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
1.	Set FD A switch to ON.	On Capt ADI: command bar comes into view and is centered and level.
2.	On attitude system test set: set selector to VG 1 PITCH. Set and hold VG 1 PITCH switch to CLIMB until API indicates 8°, release VG 1 PITCH switch and immediately set VG 1/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates 8 degrees down, and command bar commands nose-down pitch.
		On FCES computer, ATTITUDE GYROS indicator shows yellow at approx. 4 degrees with pitch computer No. 1 without Collins SB37, and approx. 6 degrees with pitch computer No. 1 with SB37.
3.	Set VG 1/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees, and command bar is centered.
4.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST		
TEST	ACTION	CHECK
5.	Set and hold VG 1 PITCH switch to DIVE until API indicates 8°, release VG 1 PITCH switch and immediately set VG 1/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates 8 degrees UP, and command bar commands nose-up pitch. On FCES computer: ATTITUDE GYROS indicator shows yellow at approx. 4 degrees with pitch computer No. 1 without Collins SB37, and approx. 6 degrees with pitch computer No. 1 with Collins SB37.
6.	Set VG 1/ERECTION CUT OFF switch to OFF.	On Capt ADI: artifical horizon indicates 0 degrees, and command bar is centered.
7.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
8.	Set FD B switch to ON.	On F/O ADI: command bar comes into view and is centered and level.
9.	Set selector to VG 2 PITCH. Set and hold VG 2 PITCH switch to climb until API indicates 8°, release VG 2 PITCH switch and immediately set VG 2/ERECTION CUT OFF switch to ON.	On F/O ADI: artificial horizon indicates 8 degrees down, and command bar commands nose-down pitch. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow at approx. 4 degrees with pitch computer No. 2 without Collins SB37, and approx. 6 degrees with pitch computer No. 2 with Collins SB37.

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
10.	Set VG 2/ERECTION CUT OFF switch to OFF.	On F/O ADI: artificial horizon indicates 0 degrees, and command bar is centered.
11.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
12.	Set and hold VG 2 PITCH switch to DIVE until API indicates 8°, release VG 2 PITCH switch and immediately set VG 2/ERECTION CUT OFF switch to ON.	On F/O ADI: artificial horizon indicates 8 degrees UP, and command bar commands nose-up pitch. On FCES computer: ATTITUDE GYROS FIM shows yellow at approx. 4 degrees with pitch computer No. 2 without Collins SB37, and approx. 6 degrees with pitch computer No. 2 with Collins SB37.
13.	Set VG 2/ERECTION CUT OFF switch to OFF.	On F/O ADI: artificial horizon indicates 0 degrees, and command bar is centered.
14.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
15.	Switch on ILS test set and adjust 'localizer' and glideslope controls to establish zero deviation on HSI.	

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
16.	On NAV MODE panel: depress A/L switchlight to turn on A/L light.	On both AFCS MODES annunciators: ARM and LOC ARM messages are displayed, and are replaced by LOC and GS messages within 10 seconds. On both AFCS WARNING Indicators: NO ALIGN and NO FLARE messages are displayed within 45 seconds. On both ADI: command bars are biased out-of-view within 45 seconds.
17.	Set selector to VG 1 ROLL. Set and hold VG 1 ROLL switch to RIGHT until API indicates 5°, release VG 1/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates airplane left roll of 5 degrees. On FCES computer: ATTITUDE GYROS FIM shows yellow.
18.	Set VG 1/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates zero degrees.
19.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM shows black.
20.	Set and hold VG 1 ROLL switch to LEFT until API indicates 5°, release VG 1 ROLL switch and immediately set VG 1/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates airplane right roll of 5 degrees. On FCES computer: ATTITUDE GYROS FIM shows yellow.

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
21.	Set VG 1/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.
22.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
23.	Set selector to VG 2 ROLL. Set and hold VG 2 ROLL switch to RIGHT until API indicates 5°, release VG 2 ROLL switch and immediately set VG 2 ERECTION CUT OFF switch to ON.	On F/O ADI: artificial horizon indicates airplane left roll of 5 degrees. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
24.	Set VG 2 ERECTION CUT OFF switch to OFF.	On F/O ADI: artificial horizon indicates 0 degrees.
25.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
26.	Set and hold VG 2 ROLL switch to LEFT until API indicates 5°, release VG 2 ROLL switch and immediately set VG 2 ERECTION CUT OFF switch to ON.	On F/O ADI: artificial horizon indicates airplane right roll of 5 degrees. On FCES computer: ALTITUDE GYROS FIM indicator shows yellow.
27.	Set VG 2 ERECTION CUT OFF switch to OFF.	On F/O ADI: artificial horizon indicates 0 degrees.
28.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
29.	On Capt INSTR SOURCE SELECT panel:	Depress ATT switchlight to ALTN.

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
30.	Set FD B switch to OFF.	
31.	On CB 1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker.	On F/O AFCS MODES annunciator: LOC and GS messages are removed.
32.	Set selector to VG 3 ROLL. Set and hold VG 3 ROLL switch to RIGHT until API indicates 5°, release VG 3 ROLL switch and and immediately set VG 3 ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates airplane left roll of 5 degrees. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
33.	Set VG 3 ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.
34.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
35.	Set and hold VG 3 ROLL switch to LEFT until API indicates 5°, release VG 3 ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates airplane right roll of 5 degrees. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
36.	Set VG 3 ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.
37.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
38.	Set selector to VG 3 PITCH. Set and hold VG 3 PITCH to CLIMB until API indicates 10°, release VG 3 PITCH switch and immediately set VG 3/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates 10 degrees down. FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
39.	Set VG 3/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.
40.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
41.	Set and hold VG 3 PITCH switch to DIVE until API indicates10°, release VG 3 PITCH switch and immediately set VG 3/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates 10 degrees UP. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
42.	Set VG 3/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicated 0 degrees.
43.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
44.	Set FD A switch to OFF.	On Capt AFCS MODES annunciator: LOC and GS messages are removed.
45.	On CB 1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker.	
46.	On CB 1, close A6 and A24 circuit breakers.	

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
47.	Set FD B switch to ON.	On F/O ADI: command bar comes into view and is centered and level.
48.	On NAV MODE panel: depress A/L switchlight to turn on A/L light.	On both AFCS MODES annunciators: GS ARM and LOC ARM messages are displayed, and are replaced by LOC and GS messages within 10 seconds. On both AFCS WARNING indicators: NO ALIGN and NO FLARE messages are displayed within 45 seconds. On F/O ADI: command bar is biased out-of-view within 45 seconds.
49.	On CB1, open A6 circuit breaker.	On Capt AFCS MODES annunciator: LOC and GS messages are removed.
50.	Set selector to VG 3 ROLL. Set and hold VG 3 ROLL switch to RIGHT until API indicates 5°, release VG 3 ROLL switch and immediately set VG 3 ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates airplane right roll of 5 degrees. FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
51.	Set VG 3 ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.
52.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST

TEST	ACTION	CHECK
53.	Set and hold VG 3 ROLL switch to LEFT until API indicates 5°, release VG 3 ROLL switch and immediately set VG 3/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates airplane left roll of 5 degrees. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
54.	Set VG 3/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.
55.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
56.	Set selector to VG 3 PITCH. Set and hold VG 3 PITCH switch to CLIMB until API indicates 10°, release VG 3 PITCH switch and immediately set VG 3/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial indicates 10 degrees DOWN. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
57.	Set VG 3/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.
58.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
59.	Set and hold VG 3 PITCH switch to DIVE until API indicates 10°, release VG 3 PITCH switch and immediately set VG 3/ERECTION CUT OFF switch to ON.	On Capt ADI: artificial horizon indicates 10 degrees UP. On FCES computer: ATTITUDE GYROS FIM indicator shows yellow.
60.	Set VG 3/ERECTION CUT OFF switch to OFF.	On Capt ADI: artificial horizon indicates 0 degrees.

Extended DANA/NO DUAL Test (Cont)
Table 503

VERTICAL GYRO TEST		
TEST	ACTION	CHECK
61.	On FCES computer: depress RESET switch.	On FCES computer: ATTITUDE GYROS FIM indicator shows black.
62.	On Capt INSTR SOURCE SELECT panel: depress ATT switchlight to off (dark).	
63.	Set FD B switch to OFF.	

Extended DANA/NO DUAL Test
Table 503

YAW RATE GYRO TEST

TEST	ACTION	CHECK
1.	On galley ceiling, zone 135, yaw rate gyro No. 1: remove the bolts from the two mounting pads which are farthest from the gyro cable connector, and loosen the third bolt so that the gyro may be rotated about it	
2.	Set FD A switch to ON.	On Capt ADI: command bar comes into view and is centered and level.
3.	Rotate gyro approximately 20 degrees counterclockwise (looking up) in approximately 2 seconds.	On Capt ADI: command bar temporarily commands left roll.
4.	Rotate gyro approximately 20 degrees clockwise (looking up) in approximately 2 seconds.	On Capt ADI: command bar temporarily commands right roll.
5.	Set FD A switch to OFF.	On Capt ADI: command bar is biased out-of-view.
6.	Set flaps to 33 degrees.	
7.	On CB 1: open NO. 1 SYSTEMS - YAW SAS (A5) circuit breaker.	On FCES panel: YAW SAS 1 switchlight FAIL legend is displayed.
8.	Disconnect yaw rate gyro No. 1 cable.	
9.	On CB 1: close A5 circuit breaker.	On FCES computer: YAW RATE GYRO 1 FIM indicator shows yellow.
10.	On CB 1: open A5 circuit breaker.	

Extended DANA/NO DUAL Test (Cont)
Table 503

YAW RATE GYRO TEST

TEST	ACTION	CHECK
11.	Connect cable to yaw rate gyro No. 1, install mounting bolts, and tighten as required for a secure mounting.	
12.	On CB 1: close A5 circuit breaker and wait one full minute before continuing.	
13.	On FCES panel: depress YAW SAS 1 switchlight to OFF and then to on (dark).	
14.	On yaw rate gyro No. 2: remove the bolts from the two mounting pads which are farthest from the gyro cable connector, and loosen the third bolt so that the gyro may be rotated about it.	
15.	Set FD B switch to ON.	On F/O ADI: command bar comes into view and is centered and level.
16.	Rotate gyro approximately 20 degrees counterclockwise (looking up) in approximately 2 seconds.	On F/O ADI: command bar temporarily commands left roll.
17.	Rotate gyro approximately 20 degrees clockwise (looking up) in approximately 2 seconds.	On F/O ADI: command bar temporarily commands right roll.
18.	Set FD B switch to OFF.	On F/O ADI: command bar is biased out-of-view.
19.	On CB1: open NO. 2 SYSTEMS - YAW SAS (A23) circuit breaker.	On FCES panel: YAW SAS 2 switchlight FAIL legend is displayed.

Extended DANA/NO DUAL Test (Cont)
Table 503

YAW RATE GYRO TEST

TEST	ACTION	CHECK
20.	Disconnect yaw rate gyro No. 2 cable.	
21.	On CB1: close A23 circuit breaker.	On FCES computer: YAW RATE GYRO 2 FIM indicator shows yellow.
22.	On CB1: open A23 circuit breaker.	
23.	On CB2: open FLIGHT STATION MISC - R AOA (F1) circuit breaker.	On FCES panel: YAW SAS 1 switchlight FAIL legend is displayed.
24.	Wait approximately 2 minutes for yaw rate gyro No. 2 and No. 3 to spin down. Then swap yaw rate gyros No. 2 and No. 3. • For gyro installed in position No. 2, use one bolt for gyro installation as described above. • For gyro installed in position No. 3, leave cable disconnected until performing Step 31	
25.	On CB2: close F1 circuit breaker.	On FCES computer: YAW RATE GYRO 3 FIM indicator shows yellow.
26.	On CB2: open F1 circuit breaker.	
27.	On CB1: open A5 circuit breaker.	
28.	On FCES computer: depress RESET switch.	On FCES computer: YAW RATE GYRO 1, 2, and 3 FIM indicators show black.

Extended DANA/NO DUAL Test (Cont)
Table 503

YAW RATE GYRO TEST		
TEST	ACTION	CHECK
29.	On CB1: close A5 circuit breaker. On CB2: close F1 circuit breaker.	On FCES computer: YAW RATE GYRO 1 and 3 FIM indicators show yellow.
30.	On CB2: open F1 circuit breaker.	
31.	Connect yaw rate gyro No. 3 cable to remaining gyro (previously removed from gyro No. 2 mount). Install gyro securely in gyro No. 3 mount.	
32.	On CB1: close A23 circuit breaker. On CB2: close F1 circuit breaker.	On FCES computer: YAW RATE GYRO 2 FIM indicator shows yellow. Wait one full minute before proceeding with test.
33.	On FCES panel: depress YAW SAS 1 and 2 switchlights to OFF then to on (dark).	
34.	Set FD B switch to ON.	On F/O ADI: command bar comes into view and is centered and level.
35.	Rotate gyro in position No. 2 approximately 20 degrees counterclockwise (looking up) in approximately two seconds.	On F/O ADI: command bar temporarily commands left roll.
36.	Rotate gyro in position No. 2 approximately 20 degrees clockwise (looking up) in approximately two seconds.	On F/O ADI: command bar temporarily commands right roll.
37.	Set FD B switch to OFF.	

Extended DANA/NO DUAL Test (Cont)
Table 503

YAW RATE GYRO TEST		
TEST	ACTION	CHECK
38.	Install yaw rate gyro No. 2 securely in mount.	

Extended DANA/NO DUAL Test
Table 503

TEST COMPLETION

TEST	ACTION	CHECK
1.	Turn off hydraulic power (Ref. 29-11-00).	
2.	Install AFCS/MLG accessory unit.	
3.	On CB1: remove TAG and close MISC-RAT AUTO DEPLOY (L3) circuit breaker.	
4.	Turn off electrical power (Ref. 24-00-00).	
5.	Remove RAT ground safety lock (Ref. 29-21-00).	
6.	Disconnect test set from VGs.	

AUTO FLIGHT - INSPECTION AND CHECK

1. General

The auto flight inspection and check consists of a preparation procedure, nineteen checks for dormant failures, and a completion procedure. The checks can be performed separately by first performing preparation, then desired check, and completion. When faults are detected during inspection and
R check, refer to Paragraph 5. Purpose of this check is to ensure
R proper auto flight operation, including not only autoland
R operations, but also many other functions critically related to
R safety.

The inspection and check requires that all auto flight system components and associated equipment are installed and operational. Also, performing concurrent tests on other aircraft systems should be avoided, since they may interfere with the performance of this test.

Warning annunciations and/or fail lights that appear, in addition to those specifically called out in these procedures, do not necessarily invalidate this inspection and test procedure. They merely indicate that a procedural fault or a unit failure has occurred and can be corrected separately from this procedure.

NOTE: Fault isolation and correction must be accomplished prior to continuing with this test.

WARNING: NO CHANGE SHOULD BE MADE TO THIS PROCEDURE, OTHERWISE TEST MAY BE INVALID.

2. Equipment and Materials

Radio Altimeter Test Set, Collins Radio 980N-1 with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable Assembly.

NOTE: To preclude possible radio altimeter mutual interference problems, use of the 980N-1 Dual Adapter (active) cable, with the radio altimeter test set is recommended.

If the 980N-1 (passive) Adapter Cable is used for autoland testing, temporary shielding of the radio altimeter antennas may be required for successful completion of the test.

CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED FOR SHIELDING MUST BE SUCH THAT REMOVAL BEFORE FLIGHT IS GUARANTEED.

VOR/ILS Ramp Test Set T-30, or equivalent.

Interphone cable set (approximately 25 feet) to reach from MESC to accelerometer location in forward galley.

Three aluminum shims 0.10-inch thick with safety streamers (for nose and main landing gear oleo proximity sensors - Ref. 32-63-00).

Four steel shims 0.05-inch thick (4130 steel or equivalent) with safety streamers (for main landing gear truck proximity sensors - Ref. 32-61-00).

Recommended Hydraulic Power Source

Hydraulic Systems A and B: 40 GPM at 3000 psi

Hydraulic Systems C and D: 40 GPM at 3000 psi

3. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
32-61-00	Landing Gear Position Indicating and Warning System - Adjustment and Test
32-63-00	Air/Ground Sensing System - Maintenance Practices
34-14-00	Central Air Data Computer System - Maintenance Practices
34-21-00	Attitude Reference System - Maintenance Practices
34-43-00	Inertial Navigation System - Maintenance Practices
34-22-00	Magnetic Heading Reference System - Maintenance Practices
34-32-00	Radio Altimeter System - Maintenance Practices
34-33-00	Instrument Landing System - Maintenance Practices

4. Functional Check and/or Test of Wiring Provisions

A. Preparation

WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-00-00, Page 201).

(3) On pilots overhead circuit breaker panel CB1 (called CB1 in rest of procedure), close following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

Row A - A1, A2, A5 through A8, A20, A23 through A26

Row B - B3, B4 through B9, B19, B27

NO. 1 NAVIGATION

RADIO ALTM (D4)

INSTR XFMR NO. 2 (D9)

ILS (G4)

DIR GYRO (G5)

CMPS COUPLER (G7)

AIR DATA CMPTR (G8)

NO. 1 NAVIGATION AND INSTRUMENT

ALT SOURCE SEL - CAPTS INSTR (E1)

ALT SOURCE SEL - F/O INSTR (E2)

NO. 1 INSTRUMENT

CAPT - ADI (F2)

CAPT - HSI (F3)

CAPT - ALTM (F4)

INSTR XFMR NO. 1 (F5)

MISC - ANN RESET (L9)

AURAL WARN - MULT SND (L8)

NO. 2 NAVIGATION

RADIO ALTM (D22)

INSTR XFMR NO. 3 (D27)

ILS (G22)

DIR GYRO (G23)

INS/VERT GYRO (G24)

CMPS CPLR (G26)

AIR DATA CMPTR (G27)

NO. 2 NAVIGATION AND INSTRUMENTS

INS-3/GYRO-3 (E24)

NO. 2 INSTRUMENTS

FO - ADI (F20)

FO - HSI (F21)

26 VAC NAV EXCITATION

CMPS CPLR-2 (J19)CMPS CPLR-1 (K19)

CMPS CPLR-1 (K24)

(4) On FE/SO overhead circuit breaker panel CB2 (called CB2 in rest of procedure), close following circuit breakers:

FLIGHT STATION MISC - R AOA (F1)

AFCS WARNING - CAPT (K18)

AFCS WARNING - F/O (K19)

DLC SERVO A (H14)

DLC SERVO B (H15)

(5) On CB1, open and tag MISC-RAT AUTO DEPLOY (L3) circuit breaker. On CB2, open and tag NOSE STEERING (F19) circuit breaker.

(6) Verify that following systems are on:

Central air data computer system (Ref. 34-14-00)

Attitude reference system (Ref. 34-21-00)

Magnetic heading reference system (Ref. 34-22-00)

Radio Altimeter system (Ref. 34-32-00)

Instrument landing system (Ref. 34-33-00)

(7) On Capt and F/O INSTRUMENT SOURCE SELECT PANELS, all switchlights shall be off (dark) for entire test.

(8) Ensure that both HSI compass cards indicate same aircraft heading. Compass cards must agree to within 6 degrees of each other.

NOTE: The local magnetic environment may cause disagreement between the HSI indications. In this event, both compass systems must be switched to the DG mode. Under these conditions, the alignment between the compass systems must be checked prior to performing any test which requires engagement of the autoland mode. A difference between systems of more than 6 degrees will cause display of the NO ALIGN message on the AFCS WARNING indicators.

(9) On HEADING/PITCH MODE panel, set HEADING readout to aircraft heading.

(10) On NAV MODE panel, set both COURSE readouts to aircraft heading.

(11) On glareshield, set both VHF NAV frequency selectors to 108.1 MHz.

(12) Position VOR/ILS ramp test set T-30 in cockpit. Set LOC and GS selectors to VARIABLE and establish zero LOC and GS beam deviation indications on HSI. Turn on localizer and glideslope POWER switches as required during test to preserve batteries.

(13) On APFDS ENGAGE panel, ensure that FD switches A and B are set to OFF.

NOTE: FD switches shall remain in OFF position unless otherwise directed in procedure.

(14) On APFDS ENGAGE panel, ensure that AP engage switches A and B are set to OFF.

(15) Connect radio altimeter test set as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) On test set, set TEST SELECT switch to OFF.

NOTE: If a long cable is available for the radio altimeter test set, the test set should be located in the flight station, with the cable routed to the radio altimeter RTs via the galley overhead egress door (located just forward of the right P3 door). This setup will result in worthwhile time savings.

(c) In mid electrical service center, connect test set plug P2 to TEST connector on radio altimeter RT No. 1. Connect test set plug P1 to TEST connector on radio altimeter RT No. 2.

(d) Close D4 and D22 circuit breakers.

(e) Using test set, establish an altitude of 480 (±20) feet as indicated on instrument panel radio altitude indicators.

(16) Verify that RAT ground safety lock is installed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

WARNING: THE HORIZONTAL STABILIZER WILL ALWAYS RETURN TO THE +1 DEGREE POSITION (AGAINST ACTUATOR STOPS) INDEPENDENT OF THE POSITION OF THE COLUMNS WHENEVER ALL HYDRAULIC SYSTEMS ARE OFF. THEREFORE, AFTER ALL TESTS, THE CONTROL COLUMNS SHALL BE POSITIONED TO OBTAIN A +1 DEGREE READING ON THE SURFACE POSITION INDICATOR (SPI) BEFORE SHUTTING DOWN THE HYDRAULIC SYSTEMS.

DURING PERFORMANCE OF FOLLOWING TESTS, THE PILOTS CONTROL COLUMNS AND WHEELS WILL MOVE. STAY CLEAR OF THESE CONTROLS AT ALL TIMES.

(17) Turn on hydraulic systems A, B, C and D (Ref. 29-11-00). Do not use aircraft electrical hydraulic pumps for this check except as necessary to complete check. Do not exceed 20 minutes of continuous operation.

NOTE: If hydraulic power is turned off during tests, FCES panel YAW SAS 1 and 2 switchlights should be cycled OFF, then back on after hydraulic power is restored, to prevent inadvertent NO DUAL message displays.

Hydraulic power requirements may be minimized by depressing the following PFCS panel switchlights to OFF:

SPOILER (ALL)

AILERON: L OUTBD, R INBD, R OUTBD

STABILIZER: A and D

(18) On center console, set manual PITCH TRIM WHEEL to an index of approximately 5.5. (This position and the corresponding control column position will be called neutral position for this test).

(19) On center console, set manual ROLL trim wheel to an index of zero.

(20) On FCES panel, depress following switchlights to OFF.

YAW SAS 1 and 2

STALL WARN 1 and 2

PITCH TRIM 1 and 2

DLC/AUTO SPLR 1 and 2

ATS 1 and 2

MACH TRIM 1 and 2

R (21) On aircraft 001-C17, on flight control panel, depress MACH FEEL 1 and 2 switchlights to OFF, and ensure that ±30° switchlight legend is illuminated.

R (21) On aircraft 018-999, on flight control panel, depress MACH FEEL 1 and 2 switchlight to OFF.

(22) On FCES panel, depress following switchlights to on (dark):

YAW SAS 1 and 2

PITCH TRIM 1 and 2

(23) On PFCS MONITOR panel, ensure that RUDDER switch and L INBD AILERON switches are set to on, and that B and C STABILIZER switches are on.

(24) Set all throttle levers to idle.

(25) Set flaps to 33 degrees if starting tests at paragraphs 4C and up. If starting test at Paragraph 4B, set flaps to 0 degrees.

NOTE: CONTROL COLUMN MOTION AND AP LIMIT. During tests with the approach or autoland mode engaged, the control columns will move and the pitch trim wheels on the center console will rotate at various times during the glideslope capture and track sequence. Column and trim wheel motion can be temporarily stopped, or reversed, by carefully adjusting the glideslope beam error signal output from the test set. If the columns reach their limit of travel in the fore or aft direction under these conditions and the beam error signal is not changed, an AP LIMIT message may be displayed on both AFCS WARNING indicators at some time thereafter. These actions and the warning messages may be ignored during performance of the various tests, except as specifically noted herein. Column motion will also result when the normal accelerometers are exercised. When the autopilot is disengaged, the AP LIMIT messages will be removed from view.

CONTROL WHEEL MOTION. During tests with the autoland mode engaged, the pilots control wheels will move in response to localizer beam error signal inputs and tilting the lateral accelerometers.

AIRPLANE OSCILLATION. During tests with the autoland mode engaged, the airplane may oscillate at a low frequency due to stabilizer motion/normal accelerometer interaction. This oscillation is a normal airplane/AFCS ground testing characteristic and may be ignored during performance of the various tests. Oscillation amplitude is decreased when AP LIMIT warning messages are displayed, or if the glideslope beam error is adjusted to minimize motion of the stabilizer when AP LIMIT messages are not displayed. (To reduce stabilizer motion, a glideslope beam error signal greater than zero volts may be required).

DUAL A/L NOT AVAIL (DANA) FUNCTION. The DANA message will be displayed on the Caution and Warning Panel when certain simulated faults are introduced into the system. Under some conditions, the fault logic which causes the display will remain latched up after the autopilot is disengaged and the simulated fault is removed, resulting in display of the message at each subsequent autopilot engagement. This can result in interference with subsequent tests due to nuisance autopilot disconnects or NO DUAL message displays on the AFCS WARNING indicators. To correct this condition, the YAW SAS 1 and 2 switchlights on the FCES panel should be depressed to OFF and then back to ON (Cycle YAW SAS) and the PITCH & ROLL (A6) and (A24) circuit breakers on CB1 should be opened and then closed.

Instructions to do this have been included in the test procedures as required; however, if the DANA message is displayed due to a nuisance fault indication or an error in performing the procedure, the above steps should be taken to unlatch the DANA logic circuits. If display of the DANA message persists, a real system fault is indicated, and the problem should be isolated and corrected before proceeding with the test.

RUDDER HARDOVER. During tests with the autoland mode engaged, the rudder may drive to a hardover

position as a function of the amplitude and duration of localizer deviation signals. Also, it may take an appreciable time to drive the rudder in the opposite direction when the localizer deviation input is reversed. Both of these characteristics are normal and may be ignored in the absence of any indicated fault conditions.

CONTROL SURFACE DRIFT. During ground tests with the autoland mode engaged, the airplane control surfaces may drift to full deflection although system input command signals are apparently at zero. This operation is normal, and is the result of the integration of small error signals in the system which are not compensated for by airplane response to control surface position. Over a relatively long time period (1 minute or more), differences between the integrated signals may result in a fault indication. To avoid nuisance indications of this type during the performance of an autoland test, the pace of testing should be steady and even, and long time intervals between successive steps of a test should be avoided.

B. Rudder Hook Monitor and Yaw Solenoid Engage Test

(1) Set flaps to 0 degrees.

(2) Rapidly rotate Capt control wheel full clockwise (CW) and hold for twenty seconds.

RESULT:

On surface position indicator (SPI), RUD indicator moves to right approximately 6 degrees. (Less than 4 degrees or more than 10 degrees indicates a fault).

(3) Release control wheel.

(4) Depress YAW SAS 1 and 2 switchlights to OFF.

(5) Rotate Capt control wheel full CW.

RESULT:

On SPI, no RUD indicator movement should be observed.

(6) Release control wheel.

(7) Depress YAW SAS 1 and 2 switchlights to on (dark).

(8) Set flaps to 33 degrees.

C. Autopilot Command Mode (One Ground or Hot Fault), Command Disconnect Warning, Roll Valid A, and AP Disconnect Warning Test

(1) Set AP engage switch A to CWS.

(2) On HEADING/PITCH MODE panel, depress VS and HDG switchlights.

RESULT:

On both AFCS MODES annunciators, no messages are displayed.

(3) Set AP engage switch A to CMD.

(4) Depress VS and HDG switchlights to on.

RESULT:

On both AFCS MODES annunciators, VS and HDG SEL messages are displayed.

(5) On CB1, open AIR DATA CMPTR (G8) circuit breaker.

RESULT:

AP engage switch A drops to CWS.

On both AFCS MODES annunciators, VS and HDG SEL messages are removed.

On both AFCS WARNING indicators, CMD DISC messages and flashing ALERT lights are displayed.

NOTE: In following procedures, a flashing ALERT light will be observed whenever a message is displayed on AFCS WARNING indicator.

(6) Perform following steps (a) and (b). Steps (c) through (f) are only performed when CMD DISC message is removed during Step (b).

(a) On CB2, open F/O AFCS WARNING (K19) circuit breaker.

R RESULT: On Capt AFCS WARNING indicator, CMD DISC message is still displayed.

(b) On CB1, open PITCH & ROLL (A24) circuit breaker.

RESULT: The CMD DISC message should remain displayed.

NOTE: Steps (c) thru (f) are only performed when CMD DISC message is removed during step (b).

(c) On CB1, close G8 circuit breaker.

(d) Wait for CADC flags to clear, and set AP engage switch A to CMD.

(e) Depress VS and HDG switchlight to on.

RESULT: On Capt AFCS MODES annunciator, VS and HDG SEL messages are displayed.

(f) On CB1, open G8 circuit breaker.

RESULT: AP engage switch A drops to CWS.

On Capt AFCS MODES annunciator, VS and HDG SEL messages are removed.

R On Capt AFCS WARNING indicator, CMD DISC message is displayed.

(7) On CB1, open CMPS COUPLER (G7) circuit breaker:

RESULT:

AP engage switch A drops to OFF.

On Capt AFCS WARNING indicator, AP DISC message is displayed.

On both AFCS WARNING indicators, CMD DISC messages are removed.

(8) On CB1, close G7, G8 and A24 circuit breakers.

(9) On CB2, close K19 circuit breaker.

(10) Set AP engage switch B to CWS.

(11) Depress VS and HDG switchlights.

RESULT:

On both AFCS MODES annunciators, no messages are displayed.

(12) Set AP engage switch B to CMD.

(13) Depress VS and HDG switchlights to on.

RESULT:

On both AFCS MODES annunciators, VS and HDG SEL messages are displayed.

(14) On CB1, open AIR DATA CMPTR (G27) circuit breaker.

RESULT:

AP engage switch B drops to CWS.

On both AFCS MODES annunciators, VS and HDG SEL messages are removed.

On both AFCS WARNING indicators, CMD DISC messages are displayed.

(15) Perform following steps (a) and (b). Steps (c) thru (f) are only performed when CMD DISC message is removed during Step (b).

(a) On CB2, open CAPT AFCS WARNING (K18) circuit breaker.

R RESULT: On F/O AFCS WARNING indicator, CMD DISC message is still displayed.

(b) On CB1, open PITCH & ROLL (A6) circuit breaker.

RESULT: The CMD DISC message should remain displayed.

NOTE: Steps (c) thru (f) are only performed when CMD DISC message is removed during step (b).

(c) On CB1, close G27 circuit breaker.

(d) Wait for CADC flags to clear, and set AP engage switch B to CMD.

(e) Depress VS and HDG switchlight to on.

RESULT: On F/O AFCS MODES annunciator, VS and HDG SEL messages are displayed.

(f) On CB1, open G27 circuit breaker.

RESULT: AP engage switch B drops to CWS.

On F/O AFCS MODES annunciator, VS and HDG SEL messages are removed.

R On F/O AFCS WARNING indicator, CMD DISC message is displayed.

(16) On CB1, open CMPS COUPLER (G26) circuit breaker.

RESULT:

AP engage switch B drops to OFF.

On F/O AFCS WARNING indicator, AP DISC message is displayed.

On both AFCS WARNING indicators, CMD DISC messages are removed.

(17) On CB1, close G26, G27 and A6 circuit breakers.

(18) On CB2, close K18 circuit breaker.

D. Inhibit Autotrim (One Open, or Ground Fault), Command Engage Enable, and CWS Engage Enable Test

(1) On FCES panel, depress PITCH TRIM 2 switchlight to OFF.

(2) Set AP engage switch A to CMD.

(3) On Capt control wheel, rapidly rotate pitch trim thumbwheel for nose-up trim (thumb motion down).

RESULT:

On center pedestal, stabilizer trim wheels rotate.

(4) Depress PITCH TRIM 1 switchlight to OFF.

RESULT:

AP engage switch A drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are displayed.

(5) Depress PITCH TRIM 2 switchlight to on.

(6) Set AP engage switch B to CMD.

(7) On F/O control wheel, rapidly rotate pitch trim thumbwheel for nose-down trim.

RESULT:

Stabilizer trim wheels rotate.

(8) Depress PITCH TRIM 2 switchlight to OFF.

RESULT:

AP engage switch B drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are displayed.

(9) Depress PITCH TRIM 1 and 2 switchlights to on.

(10) Reset stabilizer trim wheels to neutral position.

E. Takeoff Engage and Dual A/L Not Available Annunciation

(1) On APFDS ENGAGE panel, set FD switch A to ON, and set AP engage switch A to CWS.

(2) On CB1, open PITCH & ROLL (A24) circuit breaker.

RESULT:

DUAL A/L NOT AVAIL legend on pilots annunciator panel comes on.

(3) On Capt control wheel, depress TO/GA switch.

RESULT:

On Capt AFCS MODES annunciator, TAKEOFF message is displayed. (If pitch computer No. 1 has Collins SB41 incorporated, the FD flag on the Capt ADI may come into view.)

(4) Set AP engage switch A to CMD.

(5) On HEADING/PITCH MODE panel, depress HDG switchlight to on.

RESULT:

On Capt AFCS MODES annunciator, HDG SEL message is displayed.

(6) On HEADING/PITCH MODE panel, set HEADING readout to 45 degrees more than aircraft heading.

RESULT:

AP engage switch A drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are displayed.

(7) Close A24 circuit breaker.

(8) Set FD switch A to OFF.

(9) Reset HEADING readout to aircraft heading.

(10) Set FD switch B to ON, and set AP engage switch B to CWS.

(11) On CB1, open PITCH & ROLL (A6) circuit breaker.

RESULT:

DUAL A/L NOT AVAIL legend comes on.

(12) On F/O control wheel, depress TO/GA switch. (If pitch computer No. 2 has Collins SB41 incorporated, the FD flag on the F/O ADI may come into view.)

RESULT:

On F/O AFCS MODES annunciator, TAKEOFF message is displayed.

(13) Set AP engage switch B to CMD.

(14) Depress HDG switchlight to on.

RESULT:

On F/O AFCS MODES annunciator, HDG SEL message is displayed.

(15) Set HEADING to 45 degrees more than aircraft heading.

RESULT:

AP engage switch B drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are displayed.

(16) Close A6 circuit breaker.

(17) Set FD switch B to OFF.

(18) Reset HEADING readout to aircraft heading.

F. Roll Command Crosstalk, Pitch Command Crosstalk, and Yaw DC Power Monitors Test

(1) Engage single-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS power switches to establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) On NAV MODE panel, depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(2) On CB1, open ILS (G4) circuit breaker.

(3) Perform roll LOC sweep as follows:

On ILS test set, slowly rotate LOC VARIABLE knob to produce a 1-bar width left, then a 1-bar width right, and then zero indication on HSI over a period of 15 to 20 seconds. (A 1-bar width right indication equals left side of bar aligned with right side of course pointer.)

RESULT:

AP engage switch A remains in CMD position.

(4) Perform GS sweep as follows:

(a) On ILS test set, slowly rotate GS VARIABLE knob to produce a 1-dot up, then a 1-dot down, and then a zero indication on HSI over a period of 15 to 20 seconds.

RESULT:

AP engage switch A remains in CMD position.

(5) On CB1, open YAW SAS (A23) circuit breaker.

RESULT:

AP engage switch A drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are displayed.

YAW SAS 2 switchlight indicates FAIL.

On both AFCS MODES annunciators, all messages are removed.

(6) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(7) Close A6, A23, A24 and G4 circuit breakers.

(8) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF and then on. Wait 5 seconds before continuing test.

(9) Engage single-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(10) On CB1, open ILS (G22) circuit breaker.

(11) Perform roll LOC sweep as described in Step (3).

RESULT:

AP engage switch B remains in CMD position.

(12) Perform GS sweep as described in Step (4).

RESULT:

AP engage switch B remains in CMD position.

(13) On CB1, open YAW SAS (A5) circuit breaker.

RESULT:

AP engage switch B drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are displayed.

YAW SAS 1 switchlight indicates FAIL.

On both AFCS MODES annunciators, all messages are removed.

(14) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(15) Close A5, A6, A24 and G22 circuit breakers.

(16) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF and then on. Wait 5 seconds before continuing test.

G. YAW AC Power Monitors and Align Enable Test

(1) Engage single-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(2) Physically hold AP engage switch A in CMD position, and open YAW SAS (A5) circuit breaker on CB1.

RESULT:

On both AFCS WARNING indicators, AP DISC and AP LIMIT messages are displayed.

YAW SAS 1 switchlight indicates FAIL.

On both AFCS MODES annunciators, ALN ARM messages are removed.

(3) Release AP engage switch A.

RESULT:

AP engage switch A drops to OFF.

All messages except AP DISC are removed.

(4) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(5) Close A5, A6 and A24 circuit breakers.

(6) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF and then on. Wait 5 seconds before continuing test.

(7) Engage single-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indication on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(8) Physically hold AP engage switch B in CMD position, and open YAW SAS (A23) circuit breaker on CB1.

RESULT:

On both AFCS WARNING indicators, AP DISC and AP LIMIT messages are displayed.

YAW SAS 2 switchlight indicates FAIL.

On both AFCS MODES annunciators, ALN ARM messages are removed.

(9) Release AP engage switch B.

RESULT:

AP engage switch B drops to OFF.

All messages except AP DISC are removed.

(10) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(11) Close A6, A23 and A24 circuit breakers.

(12) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF and then on. Wait 5 seconds before continuing test.

H. NO GA Warning, YAW No First Failure, NO DUAL Warning, and LOC AFCS Valid (Two Faults) Test

NOTE: See description of (Two Faults) in Paragraph 5.

(1) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(2) Set flaps to 0 degrees.

(3) On Second Officers console SLATS MONITOR panel, verify SLATS position indicator L and R pointers indicate zero degrees, and that all LEFT WING and RIGHT WING indicators are dark.

(4) On SLAT MONITOR panel, lift 1 LOCK/2 LOCK switchlight cover and depress switchlight to on.

(5) Set flaps to 33 degrees.

RESULT:

On both AFCS WARNING indicators, NO GA messages are displayed.

(6) On SLAT MONITOR panel, depress 1 LOCK/2 LOCK switchlight to off.

RESULT:

SLAT position indicator shows left and right slat deployment. All LEFT WING and RIGHT WING indicator lights are illuminated. On both AFCS WARNING indicators, NO GA messages are removed.

(7) Depress YAW SAS 1 switchlight to OFF.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(8) On ILS test set, slowly rotate GS VARIABLE knob (if necessary) to minimize movement of control column and remove AP LIMIT message.

(9) On CB1, open PITCH & ROLL (A24) circuit breaker.

RESULT:

AP engage switch B drops to OFF.

On Capt AFCS MODES annunciator, ALN ARM message is removed.

On F/O AFCS MODES annunciator, all messages are removed.

On both AFCS WARNING indicators, NO DUAL and NO ALIGN messages are displayed.

(10) On ILS test set, only turn off localizer POWER switch.

RESULT:

AP engage switch A drops to OFF.

On Capt AFCS MODES annunciator, all messages are removed.

On both AFCS WARNING indicators, NO DUAL and NO ALIGN messages are removed, and AP DISC messages are displayed.

(11) On CB1, open PITCH & ROLL (A6) circuit breaker.

(12) Close A6 and A24 circuit breakers.

(13) Depress YAW SAS 1 and 2 switchlights to OFF and then on. Wait 5 seconds before continuing test.

(14) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch a to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(15) Depress YAW SAS 2 switchlight to OFF.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(16) On ILS test set, slowly rotate GS VARIABLE knob (if necessary) to minimize movement of control column and remove AP LIMIT message.

(17) On CB1, open PITCH & ROLL (A6) circuit breaker.

RESULT:

AP engage switch A drops to OFF.

On F/O AFCS MODES annunciator, ALN ARM message is removed.

On Capt AFCS MODES annunciator, all messages are removed.

On both AFCS WARNING indicators, NO DUAL and NO ALIGN messages are displayed.

(18) On ILS test set, only turn off localizer POWER switch.

RESULT:

AP engage switch B drops to OFF.

On F/O AFCS MODES annunciator, all messages are removed.

On both AFCS WARNING indicators, NO DUAL and NO ALIGN messages are removed, and AP DISC messages are displayed.

(19) On CB1, open PITCH & ROLL (A24) circuit breaker.

(20) Close A6 and A24 circuit breakers.

(21) Depress YAW SAS 1 and 2 switchlights to OFF and then on. Wait 5 seconds before continuing test.

I. Roll C1 Nodes, Pitch C1 Nodes, and GS AFCS Valid (Two Faults) Test

(1) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM and GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM message change to A/L, and ALN ARM and FLR ARM message are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(2) On CB1, open ILS (G22) circuit breaker.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(3) Perform roll LOC sweep as described in Paragraph 4F, Step (3).

RESULT:

AP engage switches A and B remain in CMD position.

(4) Perform GS sweep as described in Paragraph 4F, Step (4).

RESULT:

AP engage switches A and B remain in CMD position.

(5) On ILS test set, turn off glideslope POWER switch.

RESULT:

AP engage switches A and B drop to OFF.

On both AFCS MODES annunciators, all messages are removed.

On both AFCS WARNING indicators, NO DUAL messages are removed and AP DISC messages are displayed.

(6) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(7) Close A6, A24 and G22 circuit breakers.

(8) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(9) On CB1, open ILS (G4) circuit breaker.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(10) Perform roll LOC sweep as described in Paragraph 4F, Step (3).

RESULT:

AP engage switches A and B remain in CMD position.

(11) Perform GS sweep as described in Paragraph 4F, Step (4).

RESULT:

AP engage switches A and B remain in CMD position.

(12) On ILS test set, turn off glideslope POWER switch.

RESULT:

AP engage switches A and B drop to OFF.

On both AFCS MODES annunciators, all messages are removed.

On both AFCS WARNING indicators, NO DUAL messages are removed, and AP DISC messages are displayed.

(13) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(14) Close A6, A24 and G4 circuit breakers.

J. NO FLARE Warning, NO ALIGN Warning, Align Altitude Trip, and Roll Valid B Test

(1) On CB1, open PITCH & ROLL (A24) and YAW SAS (A23) circuit breakers.

RESULT:

YAW SAS 2 switchlight indicates FAIL when A23 circuit breaker is opened.

(2) Engage approach mode as follows:

(a) On radio altitude test set, establish a simulated altitude of 130 (±5) feet as indicated on instrument panel radio altitude indicators.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress APR switchlight to on.

RESULT:

On Capt AFCS MODES annunciator, LOC ARM and GS ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

On both AFCS WARNING indicators, NO FLARE messages are displayed. Immediately perform Step (3) after NO FLARE messages are displayed.

(3) On ILS test set, slowly rotate GS VARIABLE knob (if necessary) to minimize movement of control columns and remove AP LIMIT messages.

RESULT:

On both AFCS WARNING indicators, NO ALIGN messages are displayed within 1 minute. During the following steps, it is not necessary to adjust GS.

(4) On NAV MODE panel, depress A/L switchlight to on.

RESULT:

APR switchlight goes out.

On Capt AFCS MODES annunciator, LOC, GS, A/L and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL and NO ALIGN (or AP LIMIT) messages are displayed, and NO FLARE messages are removed.

(5) Physically hold AP engage switch A in CMD position, and open YAW SAS (A5) circuit breaker on CB1.

RESULT:

On both AFCS WARNING indicators, AP DISC and AP LIMIT messages are displayed and NO ALIGN messages are removed.

YAW SAS 1 switchlight indicates FAIL.

(6) Release AP engage switch A.

RESULT:

AP engage switch A drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are still displayed.

(7) On CB1, open A6 circuit breaker, and then close A5, A6, A23 and A24 circuit breakers.

(8) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF then on. Wait 5 seconds before continuing to next step.

(9) On CB1, open PITCH & ROLL (A6) and YAW SAS (A5) circuit breakers.

RESULT:

YAW SAS 1 switchlight indicates FAIL when A5 circuit breaker is opened.

(10) Engage approach mode as follows:

(a) Radio altimeters at 130 (±5) feet.

(b) On ILS test set, turn on LOC and GS POWER switches to establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress APR switchlight to on.

RESULT:

On F/O AFCS MODES annunciator, LOC ARM and GS ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

On both AFCS WARNING indicators, NO FLARE messages are displayed. Immediately perform Step (11) after NO FLARE messages are displayed.

(11) On ILS test set, slowly rotate GS VARIABLE knob (if necessary) to minimize movement of control columns and remove AP limit messages.

RESULT:

On both AFCS WARNING indicators, NO ALIGN messages are displayed within 1 minute. During the following steps, it is not necessary to adjust GS.

(12) On NAV MODE panel, depress A/L switchlight to on.

RESULT:

APR switchlight goes out.

On F/O AFCS MODES annunciator, LOC, GS, A/L and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL and NO ALIGN (or AP LIMIT) messages are displayed, and NO FLARE messages are removed.

(13) Physically hold AP engage switch B in CMD position, and open YAW SAS (A23) circuit breaker on CB1.

RESULT:

On both AFCS WARNING indicators, AP DISC and AP LIMIT messages are displayed.

YAW SAS 2 switchlight indicates FAIL.

(14) Release AP engage switch B.

RESULT:

AP engage switch B drops to OFF.

On both AFCS WARNING indicators, AP DISC messages are still displayed.

(15) On CB1 open A24 circuit breaker, and then close A5, A6, A23 and A24 circuit breakers.

(16) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF then on. Wait 5 seconds before continuing to next step.

K. Rudder Mod Piston Engage A+ and Rudder Position Test

(1) Engage dual-channel A/L align mode as follows:

(a) Radio altimeters at 130 (±5) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(2) Rapidly move Capt rudder pedals for maximum right rudder deflection. Note that a high force level will be required.

RESULT:

On SPI, right rudder deflection greater than 20 degrees is indicated.

On FCES panel, YAW SAS 1 and 2 switchlights do not indicate FAIL.

(3) Slowly release rudder pedal force.

(4) Rapidly move Capt rudder pedals for maximum left rudder deflection.

RESULT:

On SPI, left rudder deflection greater than 20 degrees is indicated.

On FCES panel, YAW SAS 1 and 2 switchlights do not indicate FAIL.

(5) Slowly release rudder pedal force.

(6) On CB1, open YAW SAS (A23) circuit breaker.

RESULT:

AP engage switch B drops to OFF.

YAW SAS 2 switchlight indicates FAIL.

On F/O AFCS MODES annunciator, ALIGN message is removed.

NOTE: During Steps (7) and (16) monitor rudder motion on the surface position indicator. Motion should be slow, uniform, and controllable in response to localizer deviation. Any abrupt change in position indicates a rudder position transducer fault.

(7) Perform YAW LOC sweep as follows:

On ILS test set, slowly rotate LOC VARIABLE knob to produce a 1-bar width left, then a 1-bar width right, and then zero indication on HSI over a period of 15 to 20 seconds.

NOTE: Too rapid a variation of LOC input may result in YAW SAS fault indication.

RESULT:

YAW SAS 1 switchlight does not indicate FAIL.

(8) On ILS test set, adjust GS VARIABLE knob (if necessary) to minimize movement of control columns and remove AP LIMIT messages.

(9) With AP LIMIT messages removed from view, depress YAW SAS 1 switchlight to OFF.

RESULT:

On both AFCS WARNING indicators, NO ALIGN messages are displayed.

(10) Set AP engage switch A to OFF.

RESULT:

On both AFCS MODES annunciators, all messages are removed.

On both AFCS WARNING indicators, AP DISC messages are displayed.

(11) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(12) Close A6, A23 and A24 circuit breakers.

(13) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(14) Engage dual-channel A/L align mode as follows:

(a) Radio altimeters at 130 (±5) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(15) On CB1, open YAW SAS (A5) circuit breaker.

RESULT:

AP engage switch A drops to OFF.

YAW SAS 1 switchlight indicates FAIL.

On Capt AFCS MODES annunciator, ALIGN message is removed.

(16) Perform YAW LOC sweep as described in Step (7).

RESULT:

YAW SAS 2 switchlight does not indicate FAIL.

(17) On ILS test set, slowly rotate GS VARIABLE knob to minimize movement of control column and to remove AP LIMIT messages.

(18) With AP LIMIT messages removed from view, depress YAW SAS 2 switchlight to OFF.

RESULT:

On both AFCS WARNING indicators, NO ALIGN messages are displayed.

(19) Set AP engage switch B to OFF.

RESULT:

On both AFCS MODES annunciators, all messages are removed.

On both AFCS WARNING indicators, AP DISC and messages are displayed.

(20) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(21) Close A5, A6 and A24 circuit breakers.

(22) Wait 1 minute, and then depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

L. YAW Command Crosstalk Test

(1) Engage dual-channel A/L align mode as follows:

(a) Radio altimeters at 130 (±5) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(2) On CB1, open ILS (G4) circuit breaker.

R RESULT:

R DANA light comes on.

(3) Perform YAW LOC sweep as described in Paragraph 4K, Step (7).

RESULT:

Neither YAW SAS switchlight indicates FAIL.

(4) Close G4 circuit breaker.

(5) Disengage autopilot by depressing AP DISC switch on either control wheel.

(6) On CB1, open PITCH & ROLL (A6) and (A24) circuit breaker.

(7) Close A6 and A24 circuit breakers.

(8) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(9) Engage dual-channel A/L align mode as follows:

(a) Radio altimeters at 130 feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN and RLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(10) On CB1, open ILS (G22) circuit breaker.

(11) Perform YAW LOC sweep as described in Paragraph 4K, Step (7).

RESULT:

Neither YAW SAS switchlight indicates FAIL.

(12) Close G22 circuit breaker.

(13) Disengage autopilot by depressing AP DISC switch on either control wheel.

(14) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(15) Close A6 and A24 circuit breakers.

(16) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

M. Align Sensor, Rollout Sensor, and Radio Altitude Valid (Two Fault) Test

NOTE: Station one man in mid electrical service center during following test.

(1) Engage dual-channel A/L track mode as follows:

(a) On radio altitude test set, establish a simulated altitude of 170 (±5) feet as indicated on instrument panel radio altitude indicators.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 55 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(2) On CB1, open RADIO ALTM (D4) circuit breaker.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(3) On radio altitude test set, reduce simulated altitude until ROLLOUT messages are displayed on both AFCS MODES annunciators.

RESULT:

On both AFCS MODES annunciators, ALIGN and ROLLOUT messages are displayed.

On Capt AFCS MODES annunciator, FLR ARM message is displayed.

On F/O AFCS MODES annunciator, FLARE message is displayed.

(4) Disengage autopilot by depressing AP DISC switch on either control wheel.

(5) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(6) Close A6, A24 and D4 circuit breakers.

(7) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(8) Interchange radio altimeter test set cables as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) Disconnect test set cable plugs from radio altimeter RT No. 1 and 2 TEST connectors.

(c) Connect test set cable plug P1 to radio altimeter RT No. 1 TEST connector.

(d) Connect test set cable plug P2 to radio altimeter RT No. 2 TEST connector.

(e) Close D4 and D22 circuit breakers.

(f) Establish an altitude of 170 (±5) feet as indicated on Capt radio altitude indicator.

(9) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 170 (±5) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(10) On CB1, open RADIO ALTM (D22) circuit breaker.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(11) On radio altitude test set, reduce simulated altitude until ROLLOUT messages are displayed on both AFCS MODES annunciators.

RESULT:

On both AFCS MODES annunciators, ALIGN and ROLLOUT messages are displayed.

On Capt AFCS MODES annunciator, FLARE message is displayed.

On F/O AFCS Modes annunciator, FLR ARM message is displayed.

(12) Disengage autopilot by depressing AP DISC switch on either control wheel.

(13) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(14) Close A6, A24 and D22 circuit breakers.

(15) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(16) Interchange radio altimeter test set cables as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) Disconnect test set cable plugs from radio altimeter RT No. 1 and 2 TEST connectors.

(c) Connect test set cable plug P1 to radio altimeter RT No. 2 TEST connector.

(d) Connect test set cable plug P2 to radio altimeter RT No. 1 TEST connector.

(e) Close D4 and D22 circuit breakers.

(f) Establish an altitude of zero feet as indicated on F/O radio altitude indicator.

N. DLC Limit Hydraulic Pressure (One Fault) Test

(1) Place aluminum shims in all oleo proximity sensors (nose gear and both main landing gears) (Ref. 32-63-00). This simulates airborne condition. Standby to remove shims.

(2) Place steel shims in both truck proximity sensors of left main landing gear (Ref. 32-61-00).

(3) Place steel shims in both truck proximity sensors of right main landing gear (Ref. 32-61-00).

(4) Depress DLC/AUTO SPLR 1 switchlight to on.

RESULT:

On center console, speed brake lever moves to maximum position.

(5) Wait 15 seconds.

RESULT:

On caution and warning panel, the AUTO GND SPLR INOP light does not come on.

(6) Remove steel shims from right main landing gear truck sensors only.

RESULT:

Speed brake lever does not move.

(7) Wait 15 seconds.

RESULT:

The AUTO GND SPLR INOP light does not come on.

(8) Within 6 seconds, move throttle levers to full forward thrust position and then return throttle levers to idle thrust position.

RESULT:

Speed brake lever returns to DLC zero, and then moves to maximum DLC RANGE position (~16 degree spoilers).

AUTO GND SPLR INOP light comes on after a short delay and the speed brake lever returns to DLC neutral (approximately the middle of DLC RANGE).

DLC/AUTO SPLR 1 switchlight remains dark.

(9) Depress DLC/AUTO SPLR 1 switchlight to OFF.

(10) Place steel shims in both truck sensors on right main landing gear.

(11) Depress DLC/AUTO SPLR 2 switchlight to on.

RESULT:

Speed brake lever moves to within 1-1/2 inches of maximum position.

(12) Wait 15 seconds.

RESULT:

The AUTO GND SPLR INOP light does not come on.

(13) Remove steel shims from both left main landing gear truck sensors only.

RESULT:

Speed brake lever does not move.

(14) Wait 15 seconds.

RESULT:

The AUTO GND SPLR INOP light does not come on.

(15) Within 6 seconds, move throttle levers to full forward thrust position, and then return throttle levers to idle thrust position.

RESULT:

Speed brake lever returns to DLC zero, and then moves to maximum DLC range position (-16 degree spoilers).

AUTO GND SPLR INOP light comes on after a short delay and the speed brake lever returns to DLC neutral (approximately the middle of DLC RANGE).

DLC/AUTO SPLR 2 switchlight remains dark.

(16) Depress DLC/AUTO SPLR 2 switchlight to OFF.

(17) Remove aluminum shims from left and right main landing gear oleo proximity sensors.

(18) Remove steel shims from both truck sensors of left and right main landing gears.

(19) Move throttle levers to full forward thrust position, and then return the throttle levers to idle thrust position.

(20) Simultaneously depress DLC/AUTO SPLR 1 and 2 switchlights to on.

RESULT:

Speed brake lever slowly deploys to DLC neutral.

Within 15 seconds, DLC/AUTO SPLR 1 and 2 switchlights indicate FAIL.

(21) Depress DLC/AUTO SPLR 1 and 2 switchlights to OFF.

(22) Remove aluminum shims from nose landing gear proximity sensors.

CAUTION: BE SURE ALL ARTIFICIAL TARGETS ARE REMOVED FROM AIR/GROUND SENSORS.

O. YAW C1 Nodes, YAW C2 Nodes (Two Faults), and Rudder Mod Piston Engage A Test

NOTE: Station one man in galley during following test.

(1) On galley ceiling zone 135, loosen but do not remove yaw rate gyro No. 3 from mount. (Allow enough play so that gyro can be rotated slightly to produce a yaw rate signal).

(2) Engage dual-channel A/L rollout mode as follows:

(a) Radio altimeters at zero feet.

(b) On ILS test set, turn on LOC and GS POWER switches to establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN, FLARE and ROLLOUT messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(3) On CB1, open ILS (G22) circuit breaker.

(4) Perform YAW LOC sweep as described in Paragraph 4K, Step (7).

RESULT:

Neither YAW SAS switchlight indicates FAIL.

(5) Slightly rotate yaw rate gyro No. 3 in both directions.

RESULT:

YAW SAS 1 and 2 switchlights indicate FAIL.

On both AFCS WARNING indicators, NO ALIGN messages are displayed.

(6) Carefully remove yaw rate gyro No. 3 from mount with cable still connected, and rotate approximately 20 degrees in nose-right direction in approximately 1 second.

RESULT:

On SPI, no RUD indicator movement is observed during rotation.

(7) Loosely install yaw rate gyro No. 3 in mount to permit slight rotation.

(8) Close G22 circuit breaker.

(9) Disengage autopilot by depressing AP DISC switch on either control wheel.

(10) On CB1, open PITCH & ROLL (A6) and (A24) circuit breaker.

(11) Close A6 and A24 circuit breakers.

(12) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(13) Engage dual-channel A/L rollout mode as follows:

(a) Radio altimeters at zero feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN, FLARE and ROLLOUT messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(14) On CB1, open ILS (G4) circuit breaker.

(15) Perform YAW LOC sweep as described in Paragraph 4K, Step (7).

RESULT:

Neither YAW SAS switchlight indicates FAIL.

(16) Slightly rotate yaw rate gyro No. 3 in both directions.

RESULT:

YAW SAS 1 and 2 switchlights indicate FAIL.

On both AFCS WARNING indicators, NO ALIGN messages are displayed.

(17) Carefully remove yaw rate gyro No. 3 from mount with cable still connected, and rotate approximately 20 degrees in nose-right direction in approximately 1 second.

RESULT:

On SPI, no RUD indicator movement is observed during rotation.

(18) Install yaw rate gyro No. 3 properly in mount.

(19) Close G4 circuit breaker.

(20) Disengage autopilot by depressing AP DISC switch on either control wheel.

(21) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(22) Close A6 and A24 circuit breakers.

(23) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

P. Pitch C2 Nodes (Two Faults), Altitude Rate Equalization, and Pitch Computer No First Failure (Two Faults) Test

NOTE: Station one man in galley to exercise sensors, and change radio altimeter test set connectors during this test.

(1) On radio altitude test set, establish a simulated altitude of 480 (±20) feet as indicated on instrument panel radio altitude indicators.

(2) On galley ceiling zone 135 carefully remove normal accelerometer unit from mount with cables connected and tilt approximately 90 degrees in nose-up direction. Hold unit in this position throughout following steps. (Avoid moving unit suddenly. Do not let it dangle by its cables).

(3) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are diplayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(4) Disconnect accelerometer No. 3 cable.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(5) On CB1, open ILS (G22) circuit breaker:

RESULT:

AP engage switches A and B drop to OFF.

On AFCS WARNING indicators, AP DISC messages are displayed.

(6) Close G22 circuit breaker.

(7) Disconnect accelerometer No. 2 cable.

(8) Engage single-channel autoland (A/L) track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage A switch to CMD.

(d) Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(9) On ILS test set, adjust GS VARIABLE knob (if necessary) to minimize movement of control columns remove AP LIMIT messages.

(10) On CB1, open RADIO ALTM (D4) circuit breaker.

RESULT:

AP engage switch A remains in CMD.

On both AFCS WARNING indicators, NO ALIGN messages are displayed.

(11) Close D4 circuit breaker.

(12) Disengage autopilot by depressing AP DISC switch on either control wheel.

(13) On ILS test set, adjust GS VARIABLE knob for a zero beam deviation indication on HSI.

(14) Connect cables to accelerometers No. 2 and 3.

(15) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(16) Close A6 and A24 circuit breakers.

(17) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(18) Physically hold AP engage switches A and B in CMD position, and disconnect accelerometer No. 1 cable.

RESULT:

On both AFCS WARNING indicators, NO DUAL message is displayed.

(19) Release AP engage switches A and B.

RESULT:

AP engage switch A drops to OFF and AP engage switch B remains in CMD.

(20) Disengage autopilot by depressing AP DISC switch on either control wheel.

(21) Connect accelerometer No. 1 cable.

(22) Temporarily install or support normal accelerometer unit until Step (26) is performed.

(23) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(24) Close A6 and A24 circuit breakers.

(25) Reconnect radio altimeter test set as follows:

(a) On CB1, open RADIO ALTM (D4) and D22) circuit breakers.

(b) Disconnect test set cable plugs from radio altimeter RT No. 1 and 2 TEST connectors.

(c) Connect test set cable plug P1 to radio altimeter RT No. 1 TEST connector.

(d) Connect test set cable plug P2 to radio altimeter RT No. 2 TEST connector.

(e) Close D4 and D22 circuit breakers.

(f) Establish an altitude of 480 (±20) feet as indicated on radio altitude indicators.

(26) On galley ceiling zone 135, carefully remove normal accelerometer unit from mount with cables connected and tilt approximately 90 degrees in nose-up direction. Hold unit in this position throughout following steps. (Avoid moving unit suddenly. Do not let it dangle by its cables).

(27) Engage dual-channel A/L track mode as follows:

(a) Radio altitude at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(28) Disconnect accelerometer No. 3 cable.

RESULT:

On both AFCS WARNING indicators, NO DUAL message is displayed.

(29) On CB1, open ILS (G4) circuit breaker.

RESULT:

AP engage switches A and B drop to OFF.

On AFCS WARNING indicators, AP DISC messages are displayed.

(30) Close G4 circuit breaker.

(31) Disconnect accelerometer No. 1 cable.

(32) Engage single-channel autoland (A/L) track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage B switch to CMD.

(d) Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(33) On ILS test set, adjust GS VARIABLE knob (if necessary) to minimize movement of control columns and remove AP LIMIT messages.

(34) On CB1, open RADIO ALTM (D22) circuit breaker.

RESULT:

AP engage switch B remains in CMD.

On both AFCS WARNING indicators, NO ALIGN messages are displayed.

(35) Close D22 circuit breaker.

(36) Disengage autopilot by depressing AP DISC switch on either control wheel.

(37) On ILS test set, adjust GS VARIABLE knob for a zero beam deviation indication on HSI.

(38) Connect accelerometer No. 1 and 3 cables.

(39) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(40) Close A6 and A24 circuit breakers.

(41) Engage dual-channel A/L track mode as follows:

(a) Radio altitude at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(42) Physically hold AP engage switches A and B in CMD position, and disconnect accelerometer No. 2 cable.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(43) Release AP engage switches A and B.

RESULT:

AP engage switch B drops to OFF.

AP engage switch A remains in CMD.

(44) Disengage autopilot by depressing AP DISC switch on either control wheel.

(45) Connect accelerometer No. 2 cable.

(46) Install normal accelerometer unit properly in mount.

(47) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(48) Close A6 and A24 circuit breakers.

Q. Roll C2 Nodes (Two Faults) Test

NOTE: Station one man in galley during following test.

(1) On galley ceiling zone 135, carefully remove lateral accelerometer unit from mount with cables connected, and tilt approximately 90 degrees clockwise about roll axis (right wing down direction). Hold in this position throughout following steps. (Avoid moving unit suddenly. Do not let it dangle by its cables).

(2) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(3) Disconnect lateral accelerometer No. 3 cable.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(4) On CB1, open ILS (G22) circuit breaker.

RESULT:

AP engage switches A and B drop to OFF.

(5) Close G22 circuit breaker.

(6) Connect lateral accelerometer No. 3 cable.

(7) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(8) Close A6 and A24 circuit breakers.

(9) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(10) Disconnect accelerometer No. 3 cable.

RESULT:

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(11) On CB1, open ILS (G4) circuit breaker.

RESULT:

AP engage switches A and B drop to OFF.

(12) Close G4 circuit breaker.

(13) Connect accelerometer No. 3 cable.

(14) Install lateral accelerometer unit in mount properly.

R. Autothrottle Override, Inhibit Autotrim (One Hot Short Fault), Autopilot Command Mode (One Open or Ground Fault), and Autoland Track Test

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(1) In FESC, remove AFCS/MLG accessory unit from center rack. (This simulates aircraft in-air condition).

(2) Simulats a radio altitude of 480 (±20) feet.

(3) Set flaps to 22 degrees.

(4) Move throttle lever to approximately mid-thrust position.

(5) On FCES panel, depress ATS 1 switchlight to on (dark).

(6) On THRUST panel, set ATS engage switch to engaged position. Manually restrain any throttle lever motion.

(7) After approximately 5 seconds, depress ATS 1 switchlight to OFF.

RESULT:

(a) ATS engage switch drops to OFF

(b) On both AFCS WARNING indicators, ATS DISC message is displayed.

(8) On either AFCS WARNING indicator, depress ALERT switchlight twice to remove ATS DISC message from both indicators.

(9) Move throttle levers to idle thrust position.

(10) Set flap to 33 degrees.

(11) Depress PITCH TRIM 2 switchlight to OFF.

(12) Set AP engage switch A to CWS.

(13) On Capt control wheel, rapidly rotate pitch trim thumbwheel for nose-up trim.

RESULT:

On center pedestal, stabilizer trim wheels shall not rotate (some wheel "creep" may occur).

(14) Disengage autopilot by depressing AP DISC switch on either control wheel.

(15) Depress PITCH TRIM 2 switchlight to on (dark).

(16) Depress PITCH TRIM 1 switchlight to OFF.

(17) Set AP engage switch B to CWS.

(18) On F/O control wheel, rapidly rotate pitch trim thumbwheel for nose-up trim.

RESULT:

Stabilizer trim wheels shall not rotate (some wheel "creep" may occur).

(19) Disengage autopilot by depressing AP DISC switch on either control wheel.

(20) Depress PITCH TRIM 1 switchlight to on.

(21) Set AP engage switch A to CWS.

(22) Set FD switches A and B to ON.

NOTE: Ignore ADI indications.

(23) Engage single-channel A/L track mode in CWS as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, and GS ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, NO ALIGN messages are displayed on both AFCS WARNING indicators.

At display of NO ALIGN messages, stabilizer trim wheels do not rotate (some wheel "creep" may occur).

(24) Disengage autopilot by depressing AP DISC switch on either control wheel.

(25) Set FD switches A and B to OFF.

(26) Set FD switches A and B to ON.

(27) Engage single-channel A/L track mode in CWS as follows:

(a) Set AP engage switch B to CWS.

(b) Radio altimeters at 480 (±20) feet.

(c) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(d) Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, and GS ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, NO ALIGN messages are displayed on both AFCS WARNING indicators.

At display of NO ALIGN messages, stabilizer trim wheels do not rotate (some wheel "creep" may occur).

(28) Disengage autopilot by depressing AP DISC switch on either control wheel.

(29) Set FD switches A and B to OFF.

(30) On CB1, open PITCH & ROLL (A24) circuit breaker. Set stabilizer trim wheel to trim neutral position.

(31) Engage single-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI GS deviation is to be established by rotating GS switch on ramp test set to ON COURSE.

(c) Set AP engage A switch to CMD.

(d) Depress A/L switchlight to on.

RESULT:

On Capt AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After GS message is displayed, stabilizer trim wheels rotate to produce nose-down trim.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and SLR ARM messages are displayed.

Within 5 seconds after A/L message is displayed, stabilizer trim wheels rotate to produce nose-up trim.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(32) Set AP engage switch A to OFF.

(33) Close A24 circuit breaker.

(34) Set stabilizer trim wheel to trim neutral position.

(35) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(36) On CB1, open PITCH & ROLL (A6) circuit breaker.

(37) Engage single-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation on HSI. GS switch on ramp test set to ON COURSE.

(c) Set AP engage switch B to CMD.

(d) Depress A/L switchlight to on.

RESULT:

On F/O AFCS MODES annunciator, LOC ARM and GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After GS message is displayed, stabilizer trim wheels rotate to produce nose-down trim.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

Within 5 seconds after A/L message is displayed, stabilizer trim wheels rotate to produce nose-up trim.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(38) Set AP engage switch B to OFF.

(39) On CB1, open PITCH & ROLL (A24) circuit breaker.

(40) Close A6 and A24 circuit breakers.

(41) Set stabilizer trim wheel to trim neutral position.

(42) On ILS test set, rotate GS switch to VARIABLE position.

(43) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(44) In FESC temporarily install AFCS/MLG accessory unit in center rack.

S. Pitch GA Engage or A/L Track (Two Fault) and Roll GA Engage or A/L Track Test

(1) In FESC, examine the modification plate on the front of each pitch computer and note for future reference whether Collins Service Bulletin No. 36 modifications have been incorporated (number 36 location blacked out).

The balance of this test shall be performed regardless of whether or not Collins SB36 has been incorporated.

(2) On CB1, open PITCH & ROLL (A24) circuit breaker.

(3) Set FD A switch to ON.

(4) On FCES panel, depress STALL WARN 1 and 2 switchlights to on (dark).

NOTE: Steps (5) through (9) should be performed as quickly as possible.

(5) On FCES panel, depress STALL WARN - TEST switch.

RESULT:

Control columns vibrate.

(6) Release TEST switch, and immediately depress STALL WARN 1 and 2 switchlights to OFF.

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(7) In FESC, remove AFCS/MLG accessory unit from center rack.

(8) On Capt control wheel, depress TO/GA switch.

RESULT:

On Capt AFCS MODES annunciator, GO ARND message is displayed.

(9) Install AFCS/MLG accessory unit in center rack.

(10) Close A24 circuit breaker.

RESULT:

If Collins SB36 is installed in pitch computer number 1, GO ARND message on Capts AFCS MODES annunciator is removed.

(11) Engage single-channel A/L track mode as follows:

(a) Radio altimeter at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Depress A/L switchlight to on.

RESULT:

On Capt AFCS MODES annunciator, GS ARM message is displayed (GO ARND message is still displayed if not removed at Step (10) above).

On F/O AFCS MODES annunciator, LOC ARM and GS ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

(d) Immediately after GS message is displayed, set AP engage switch A to CMD.

RESULT:

On F/O AFCS MODES annunciator, LOC, GS and A/L ARM messages are displayed.

After approximately 35 seconds, A/L ARM message changes to A/L, and ALN ARM and FLR ARM messages are displayed on F/O annunciator.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(12) While monitoring aileron position on SPI, adjust LOC VARIABLE knob on ILS test set to produce a one-dot right indication on HSI for approximately 10 seconds, and then a zero indication.

RESULT:

On SPI, no aileron motion is indicated.

AP engage switch A remains in CMD position.

(13) Depress STALL WARN 1 and 2 switchlights to on.

NOTE: Steps (14) through (16) should be performed as quickly as possible.

(14) On FCES panel, depress STALL WARN - TEST switch.

RESULT:

Control columns vibrate.

(15) Release TEST switch, and immediately depress STALL WARN 1 and 2 switchlights to OFF.

(16) While monitoring stabilizer position on SPI, adjust GS VARIABLE knob on ILS test set to produce a one-dot down, then a one-dot up, and then a zero indication on HSI over a period of approximately 15 seconds.

Result:

On SPI, no stabilizer motion is indicated.

AP engage switch A remains in CMD position.

(17) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(18) Set FD A switch to OFF.

(19) Close A6 and A24 circuit breakers.

(20) Depress Yaw SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(21) On CB1, open PITCH & ROLL (A6) circuit breaker.

(22) Set FD B switch to ON.

(23) On FCES panel, depress STALL WARN 1 and 2 switchlights to on (dark).

NOTE: Steps (24) through (28) should be performed as quickly as possible.

(24) On FCES panel, depress STALL WARN-TEST switch.

RESULT:

Control columns vibrate.

(25) Release TEST switch and immediately depress STALL WARN 1 and 2 switchlights to OFF.

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(26) In FESC, remove AFCS/MLG accessory unit from center rack.

(27) On F/O control wheel, depress TO/GA switch.

RESULT:

On F/O AFCS MODES annunciator, GO ARND message is displayed.

(28) Install AFCS/MLG accessory unit in center rack.

(29) Close A6 circuit breaker.

RESULT:

If Collins SB36 is installed in pitch computer number 2, GO ARND message on F/O AFCS MODES annunciator is removed.

(30) Engage single-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Depress A/L switchlight to on.

RESULT:

On F/O AFCS MODES annunciator, GS ARM message is displayed (GO ARND message is still displayed if not removed at Step (29) above).

On Capt AFCS MODES annunciator, LOC ARM, and GS ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

(d) Immediately after GS message is displayed, set AP engage switch B to CMD.

RESULT:

On Capt AFCS MODES annunciator; LOC, GS and A/L ARM messages are displayed.

After approximately 35 seconds, A/L ARM message changes to A/L, and ALN ARM and FLR ARM messages are displayed on Capt annunciator.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

(31) While monitoring aileron position on SPI, adjust LOC VARIABLE knob on ILS test set to produce a one-dot right indication on HSI for approximately 10 seconds, and then a zero indication.

RESULT:

On SPI, no aileron motion is indicated.

AP engage switch B remains in CMD position.

(32) On FCES panel, depress STALL WARN 1 and 2 switchlights to on.

NOTE: Steps (33) through (35) should be performed as quickly as possible.

(33) On FCES panel, depress STALL WARN-TEST switch.

RESULT:

Control columns vibrate.

(34) Release TEST switch, and immediately depress STALL WARN 1 and 2 switchlights to OFF.

(35) While monitoring stabilizer position on SPI, adjust GS VARIABLE knob on ILS test set to produce a one-dot down, then a one-dot up, and then a zero indication on HSI over a period of approximately 15 seconds.

RESULT:

On SPI, no stabilizer motion is indicated.

AP engage switch B remains in CMD position.

(36) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(37) Set FD B switch to OFF.

(38) Close A6 and A24 circuit breakers.

(39) Depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

T. Go-Around Mode Engaged Test

(1) In FESC, examine the modification plate on the front of each pitch computer to determine if Collins Service Bulletin No. 36 modifications have been incorporated (number 36 location blacked out). If both computers have been modified, go to Step (2), otherwise perform test in Paragraph 4U.

(2) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(3) On ILS test set, adjust GS VARIABLE knob (if necessary) to minimize movement of control columns and remove AP LIMIT messages on AFCS WARNING indicators.

(4) On CB1, open YAW SAS (A23) circuit breaker.

RESULT:

AP engage switch B drops to OFF.

On both AFCS WARNING indicators, NO DUAL messages are displayed and NO ALIGN messages immediately after NO DUAL.

On both AFCS MODES annunciators, ALN ARM messages are removed.

YAW SAS 2 switchlight indicates FAIL.

(5) On FCES panel, depress STALL WARN 1 and 2 switchlights to on (dark).

NOTE: Steps (6) through (10) should be performed as quickly as possible.

(6) On FCES panel, depress STALL WARN-TEST switch.

RESULT:

Control columns vibrate.

(7) Release TEST switch, and immediately depress STALL WARN 1 and 2 switchlights to OFF.

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(8) In FESC, remove AFCS/MLG accessory unit from center rack.

(9) On Capt control wheel, depress TO/GA switch.

RESULT:

On Capt AFCS MODES annunciator, LOC message is removed.

On FCES panel, YAW SAS 1 switchlight indicates FAIL.

(10) On ILS test set, adjust LOC VARIABLE knob to produce a one-dot right indication on HSI.

RESULT:

AP engage switch A drops to OFF.

On both AFCS MODES annunciators, all messages are removed.

(11) Install AFCS/MLG accessory unit in center rack.

(12) On ILS test set, adjust LOC VARIABLE knob for a zero beam deviation indication on HSI.

(13) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers.

(14) Close A6, A23 and A24 circuit breakers.

(15) Wait one minute, and then depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

(16) Engage dual-channel A/L track mode as follows:

(a) Radio altimeters at 480 (±20) feet.

(b) On ILS test set, turn on LOC and GS POWER switches and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch B to CMD

(d) Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are not displayed.

(17) On ILS test set, adjust GS VARIABLE knob (if necessary) to minimize movement of control columns and remove AP LIMIT message on AFCS WARNING indicators.

(18) On CB1, open YAW SAS (A5) circuit breaker.

RESULT:

AP engage switch A drops to OFF.

On both AFCS WARNING indicators, NO DUAL messages are displayed and NO ALIGN messages immediately after NO DUAL.

On both AFCS MODES annunciator, ALN ARM messages are removed.

YAW SAS 1 switchlight indicates FAIL.

(19) On FCES panel, depress STALL WARN 1 and 2 switchlights to on (dark).

NOTE: Steps (20) through (24) should be performed as quickly as possible.

(20) On FCES panel, depress STALL WARN TEST switch.

RESULT:

Control columns vibrate.

(21) Release TEST switch, and immediately depress STALL WARN 1 and 2 switchlights to OFF.

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(22) In FESC, remove AFCS/MLG accessory unit from center rack.

(23) On F/O control wheel, depress TO/GA switch.

RESULT:

On F/O AFCS MODES annunciator, LOC message is removed.

On FCES panel, YAW SAS 2 switchlight indicates FAIL.

(24) On ILS test set, adjust LOC VARIABLE knob to produce a one-dot right indication on HSI.

RESULT:

AP engage switch B drops to OFF.

On both AFCS MODES annunciators, all messages are removed.

(25) Install AFCS/MLG accessory unit in center rack.

(26) On ILS test set, adjust LOC VARIABLE knob for a zero beam deviation indication on HSI.

(27) On CB1, open PITCH & ROLL (A6) and A24) circuit breakers.

(28) Close A5, A6 and A24 circuit breakers.

(29) Wait one minute, and then depress YAW SAS 1 and 2 switchlights to OFF, then on. Wait 5 seconds before continuing test.

U. Thirty Degree Flap Position Switch Test

(1) Set flaps to 22 degrees.

WARNING: IF TEST IS INTERRRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(2) In FESC, remove AFCS/MLG accessory unit from center rack.

(3) Set AP engage switch A to CMD.

(4) On Capt control wheel, depress TO/GA switch.

RESULT:

On both AFCS MODES annunciators, no messages are displayed.

(5) Repeat Step (4) above for F/O control wheel.

(6) Set AP engage switch A to OFF and AP engage switch B to CMD.

(7) On F/O control wheel, depress TO/GA switch.

RESULT:

On both AFCS MODES annunciators, no messages are displayed.

(8) Repeat Step (7) above for Capt control wheel.

(9) Set AP engage switch B to OFF.

(10) Install AFCS/MLG accessory unit in center rack.

(11) Set flaps to 33 degrees.

V. Completion

(1) In FESC, make certain that AFCS/MLG accessory unit is securely mounted in center rack.

CAUTION: BE SURE ALL ARTIFICIAL TARGETS ARE REMOVED FROM AIR/GROUND SENSORS.

(2) On nose landing gear, make certain that aluminum shim has been removed.

(3) On main landing gear, make certain that aluminum and steel shims have been removed.

(4) Make certain that normal accelerometers, lateral accelerometers, and yaw rate gyros are securely mounted and cable connected.

(5) Disassemble radio altimeter test setup as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) Disconnect test set cable plugs from radio altimeter RT No. 1 and 2 TEST connectors.

(c) Cap TEST connectors.

(d) Close D4 and D22 circuit breakers.

(6) On radio altimeter RT No. 1 and then No. 2, depress RESET button.

RESULT:

On both RT's, X-CONN, VSWR and IND fault indicators show black (not yellow). If R/T fault indicator shows yellow, reset it with a small magnet.

Wait at least 15 seconds and then recheck that fault indicators on both units remain black.

(7) Engage dual-channel A/L rollout mode as follows:

(a) Set FD switches A and B to ON.

RESULT:

On both ADI's, command bars come into view and are centered and level.

(b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN, FLARE and ROLLOUT messages are displayed.

On both AFCS WARNING indicators, no messages are displayed.

Stabilizer trim wheels do not rotate (some wheel "creep" may occur).

R On both ADI, command bars are biased out of view.

(8) Set FD switches A and B to OFF.

(9) Disengage autopilot by depressing AP DISC switch on either control wheel.

(10) Position control column to obtain a +1 degree STAB indication on SPI.

(11) Retract flaps after clearance to zero degrees.

(12) On FCES computer, depress RESET pushbutton to reset FIM indicators.

(13) On FCES and PFCS panels, depress all switchlights to on (dark) as required to restore normal system configuration.

(14) Turn off hydraulic power (Ref. 29-11-00).

(15) Turn off electrical power (Ref. 24-00-00).

5. Faults Detected During Check

Table 601 lists the autoland system functions which are checked using the Autoland Functional Check Procedure in Paragraph 4. In the event that the system does not operate in accordance with the specified test procedure, the functions listed in Figure 601 should be tested for the indicated failures.

R NOTE: Indicated failures must be corrected before proceeding
R with the test.

R ONE OR TWO FAULTS - In the event that a test sequence cannot be performed, the presence of one or two faults is indicated. For those individual functions identified as (two fault) types, both faults must be identified and corrected. When a two-fault condition is not indicated, a single fault condition exists.

Abbreviations used in Figure 601 are as follows:

AFCS EQUIPMENT	ASSOCIATED EQUIPMENT
AE - APFDS Engage Panel	AW - Aural Warning Unit
FC - FCES Computer	DS - Direct Lift Control Servo
FP - FCES Control Panel	IC - Indicator Lights Control Box
PC - Pitch Computer	IL - ILS Receiver
RC - Roll Computer	RA - Radio Altimeter System
SC - Speed Control Computer	RX - Rudder Position Transducer
TA - Trim Augmentation Computer	YS - Yaw Servo
WI - AFCS Warning Indicator	FS - Flap Position Switch
YC - Yaw Computer	

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4B	Rudder Hook Monitor 1	YS-P1-29	YC1-P2A-35	Hot Short
			YC2-P2B-35	Hot Short
	Rudder Hook Monitor 2	YS-P3-29	YC2-P2A-35	Hot Short
			YC1-P2B-35	Hot Short
	Yaw Solenoid Engage 1+	FP-P1-M	YS-P1-17	Hot Short
	Yaw Solenoid Engage 2+	FP-P2-M	YS-P3-17	Hot Short
4C	Autopilot CMD Mode 1	PC1-P2A-44	TA-P1B-03	Hot Short, Gnd Short
			PC2-P2A-32	Hot Short, Gnd Short
			RC1-P2A-26	Hot Short, Gnd Short
			RC2-P2A-23	Hot Short, Gnd Short
			YC1-P2A-15	Hot Short, Gnd Short
			YC2-P2A-33	Hot Short, Gnd Short
	Autopilot CMD Mode 2	PC2-P2A-44	TA-P2B-03	Hot Short, Gnd Short
			PC1-P2A-32	Hot Short, Gnd Short
			RC1-P2A-23	Hot Short, Gnd Short
			RC2-P2A-26	Hot Short, Gnd Short
			YC1-P2A-33	Hot Short, Gnd Short
			YC2-P2A-15	Hot Short, Gnd Short
	A/P CMD Disc Ann. 1	RC1-P2A-57	W11-P1-N	Open, Hot Short
			W12-P1-M	Open, Hot Short
	A/P CMD Disc Ann. 2	RC2-P2A-57	W11-P1-M	Open, Hot Short
			W12-P1-N	Open, Hot Short

M1-0103-22-760

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Indicated Failures Check List
Figure 601 (Sheet 1)

EFFECTIVITY: ALL

0018

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4C (Cont)	Roll Valid 1A	RC1-P2A-45	PC1-P2A-27	Hot Short
	Roll Valid 2A	RC2-P2A-45	PC2-P2A-27	Hot Short
	AP Disc Warn 1A	RC1-P2A-51	WI1-P1-ZT	Open, Hot Short
	AP Disc Warn 2A	RC2-P2A-51	WI2-P1-ZT	Open, Hot Short
			AW-P1-16	Open, Hot Short
	AP Disc Warn 1B	RC1-P2B-51	WI1-P1-ZN	Open, Hot Short
	AP Disc Warn 2B	RC2 P2B-51	WI2-P1-ZN	Open, Hot Short
			AW-P1-17	Open, Hot Short
4D	Inhibit Autotrim 1	PC1-P2B-48	TA-P1B-48	Open, Gnd Short
	Inhibit Autotrim 2	PC2-P2B-48	TA-P2B-48	Open, Gnd Short
	CMD Engage Enable 1	PC1-P2A-53	AE-P1-ZG	Gnd Short
	CMD Engage Enable 2	PC2-P2A-53	AE-P2-ZG	Gnd Short
	CWS Engage Enable 1	PC1-P2A-55	AE-P1-ZH	Gnd Short
	CWS Engage Enable 2	PC2-P2A-55	AE-P2-ZH	Gnd Short
4E	Takeoff Engaged 1	PC1-P2B-57	PC2-P2B-16	Gnd Short
			RC1-P2A-32	Gnd Short
			RC2-P2B-32	Gnd Short
			SC-P1B-44	Gnd Short
			YC1-P2A-08	Gnd Short
			YC2-P2B-08	Gnd Short
	Takeoff Engaged 2	PC2-P2B-57	PC1-P2B-16	Gnd Short
			RC1-P2B-32	Gnd Short
			RC2-P2A-32	Gnd Short
			SC-P2B-44	Gnd Short
			YC1-P2B-08	Gnd Short
			YC-P2A-08	Gnd Short

M1-0103-22-761

R Indicated Failures Check List
R Figure 601 (Sheet 2)

EFFECTIVITY: ALL

001B

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4E (Cont)	Dual A/L Not Avail Ann. 1	RC1-P2B-48	IC-P6-11	Open
	Dual A/L Not Avail Ann. 2	RC2-P2B-48	IC-P16-11	Open
4F	A/L CMD Crossfeed 1AA+	RC1-P1A-48	RC2-P1B-41	Open, Gnd Short
	A/L CMD Crossfeed 1AB+	RC1-P1A-50	RC2-P1B-17	Open, Gnd Short
	CMD Crossfeed Com 1A	RC1-P1A-49	RC2-P1B-29	Open
	A/L CMD Crossfeed 1BA+	RC1-P1B-48	RC2-P1A-41	Open, Gnd Short
	A/L CMD Crossfeed 1BB+	RC1-P1B-50	RC2-P1A-17	Open, Gnd Short
	CMD Crossfeed Com 1B	RC1-P1B-49	RC2-P1A-29	Open
	A/L CMD Crossfeed 2AA+	RC2-P1A-48	RC1-P1B-41	Open, Gnd Short
	A/L CMD Crossfeed 2AB+	RC2-P1A-50	RC1-P1B-17	Open, Gnd Short
	CMD Crossfeed Com 2A	RC2-P1A-49	RC1-P1B-29	Open
	A/L CMD Crossfeed 2BA+	RC2-P1B-48	RC1-P1A-41	Open, Gnd Short
	A/L CMD Crossfeed 2BB+	RC2-P1B-50	RC1-P1A-17	Open, Gnd Short
	CMD Crossfeed Com 2B	RC2-P1B-49	RC1-P1A-29	Open
	Stab CMD Crossfeed 1AA+	PC1-P1A-59	PC2-P1A-61	Open, Gnd Short
	Stab CMD Crossfeed 1AB+	PC1-P1A-58	PC2-P1A-62	Open, Gnd Short
	Stab CMD Crossfeed 1AA–	PC1-P1A-46	PC2-P1A-50	Open
	Stab CMD Crossfeed 1BA+	PC1-P1B-59	PC2-P1B-61	Open, Gnd Short
	Stab CMD Crossfeed 1BB+	PC1-P1B-58	PC2-P1B-62	Open, Gnd Short
	Stab CMD Crossfeed 1AB–	PC1-P1B-46	PC2-P1B-50	Open
	Stab CMD Crossfeed 2AA+	PC2-P1A-59	PC1-P1A-61	Open, Gnd Short

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R Indicated Failures Check List
R Figure 601 (Sheet 3)

EFFECTIVITY: ALL

001B

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4F (Cont)	Stab. CMD Crossfeed 2AB+	PC2-P1A-58	PC1-P1A-62	Open, Gnd Short
	Stab. CMD Crossfeed 2AA—	PC2-P1A-46	PC1-P1A-50	Open
	Stab. CMD Crossfeed 2BA+	PC2-P1B-59	PC1-P1B-61	Open, Gnd Short
	Stab. CMD Crossfeed 2BB+	PC2-P1B-58	PC1-P1B-62	Open, Gnd Short
	Stab. CMD Crossfeed 2AB—	PC2-P1B-46	PC1-P1B-50	Open
	SAS DC Pwr Mon 1A	YC1-P2A-47	RC1-P1A-56	Hot Short
	SAS DC Pwr Mon 1B	YC1-P2B-57	RC1-P2B-10	Hot Short
	SAS DC Pwr Mon 2A	YC2-P2A-47	RC2-P1A-56	Hot Short
	SAS DC Pwr Mon 2B	YC2-P2B-57	RC2-P2B-10	Hot Short
4G	YC AC Pwr Mon 1A	YC1-P2A-57	RC1-P2A-10	Hot Short
	SAS AC Pwr Mon 1B	YC1-P2B-46	RC1-P1B-56	Hot Short
	YC AC Pwr Mon 2A	YC2-P2A-57	RC2-P2A-10	Hot Short
	SAS AC Pwr Mon 2B	YC2-P2B-46	RC2-P1B-56	Hot Short
	Align Enable 1	YC1-P2B-17	YC2-P2A-17	Hot Short
	Align Enable 2	YC2-P2B-17	YC1-P2A-17	Hot Short
4H	No GA Warn 1	SC-P1A-50	WI1-P1-ZP	Open, Hot Short
	No GA Warn 2	SC-P2A-50	WI2-P1-ZP	Open, Hot Short
	Yaw No First Failure 1	YC1-P2A-04	RC1-P2B-41	Hot Short
	Yaw No First Failure 2	YC2-P2A-04	RC2-P2B-41	Hot Short
	No Dual Warn 1	RC1-P2B-52	WI1-P1-ZA	Open, Hot Short
			WI2-P1-E	Open, Hot Short
	No Dual Warn 2	RC2-P2B-52	WI1-P1-E	Open, Hot Short
			WI2-P1-ZA	Open, Hot Short
	LOC AFCS Warn 1	IL1-P1B-21	RC1-P1A-61	Hot Short
			RC1-P1B-57	Hot Short
	LOC AFCS Warn 2	IL2-P1B-21	RC2-P1A-61	Hot Short
			RC2-P1B-57	Hot Short

M1-0103-22-763

R Indicated Failures Check List
R Figure 601 (Sheet 4)

EFFECTIVITY: ALL

001B

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4I	Comparator R1A1	RC1-P2A-64	RC2-P2A-08	Hot Short
	Comparator R1B1	RC1-P2B-64	RC2-P2B-08	Hot Short
	Comparator R1A2	RC2-P2A-64	RC1-P2A-08	Hot Short
	Comparator R1B2	RC2-P2B-64	RC1-P2B-08	Hot Short
	Comparator P1A1	PC1-P1A-08	PC2-P1A-17	Hot Short
	Comparator P1B1	PC1-P1B-08	PC2-P1B-17	Hot Short
	Comparator P1A2	PC2-P1A-08	PC1-P1A-17	Hot Short
	Comparator P1B2	PC2-P1B-08	PC1-P1B-17	Hot Short
	GS AFCS Warn 1	IL1-P1B-24	PC1-P1A-30	Hot Short
			PC1-P1B-30	Hot Short
	GS AFCS Warn 2	IL2-P1B-24	PC2-P1B-30	Hot Short
			PC2-P1B-30	Hot Short
4J	No Flare 1	RC1-P2B-58	WI1-P1-K	Open, Hot Short
			WI2-P1-L	Open, Hot Short
	No Flare 2	RC2-P2B-58	WI1-P1-L	Open, Hot Short
			WI2-P1-K	Open, Hot Short
	Align Altitude 1	YC1-P2B-26	RC1-P2A-27	Hot Short
			TA-P1B-10	Hot Short
	Align Altitude 2	YC2-P2B-26	RC2-P2A-27	Hot Short
			TA-P2B-10	Hot Short
	No Align Warn	YC1-P2A-50	WI1-P1-H	Open, Hot Short
		YC2-P2A-50	WI2-P1-H	Open, Hot Short
		WI1-P1-H	WI2-P1-H	Hot Short
	AP Limit	PC1-P2B-67	YC1-P2A-39	Open, Gnd Short
		PC2-P2B-67	YC2-P2A-39	Open, Gnd Short

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R Indicated Failures Check List
R Figure 601 (Sheet 5)

EFFECTIVITY: ALL

0018

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4J (Cont)	Roll Valid 1B	RC1-P1B-59	PC1-P2B-27	Hot Short
	Roll Valid 2B	RC2-P1B-59	PC2-P2B-27	Hot Short
4K	Rudder Mod Piston Engage 1A+	YC1-P2A-53	YC2-P2A-44	Hot Short
	Rudder Mod Piston Engage 2A+	YC2-P2A-53	YC1-P2A-44	Hot Short
	Rudder Position 1AY	RX1-P1-02	YC1-P1A-37	Hot Short, Gnd Short, Open
	Rudder Position 1AX	RX1-P1-08	YC1-P1A-47	Hot Short, Gnd Short, Open
	Rudder Position 1BY	RX1-P1-11	YC1-P1B-37	Hot Short, Gnd Short, Open
	Rudder Position 1BX	RX1-P1-09	YC1-P1B-47	Hot Short, Gnd Short, Open
	Rudder Position 2AY	RX2-P1-02	YC2-P1A-37	Hot Short, Gnd Short, Open
	Rudder Position 2AX	RX2-P1-08	YC2-P1A-47	Hot Short, Gnd Short, Open
	Rudder Position 2BY	RX2-P1-11	YC2-P1B-37	Hot Short, Gnd Short, Open
	Rudder Position 2BX	RX2-P1-09	YC2-P1B-47	Hot Short, Gnd Short, Open
4L	Rudder Command Crossfeed 1AA+	YC1-P1A-40	YC2-P1A-10	Open, Gnd Short
	Rudder Command Crossfeed 1AB+	YC1-P1A-51	YC2-P1A-21	Open, Gnd Short
	Rudder Command Crossfeed 1A–	YC1-P1A-50	YC2-P1A-11	Open
	Rudder Command Crossfeed 1BA+	YC1-P1B-40	YC2-P1B-10	Open, Gnd Short
	Rudder Command Crossfeed 1BB+	YC1-P1B-51	YC2-P1B-21	Open, Gnd Short

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R Indicated Failures Check List
Figure 601 (Sheet 6)

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4L (Cont)	Rudder Command Crossfeed 1B–	YC1-P1B-50	YC2-P1B-11	Open
	Rudder Command Crossfeed 2AA+	YC2-P1A-40	YC1-P1A-10	Open, Gnd Short
	Rudder Command Crossfeed 2AB+	YC2-P1A-51	YC1-P1A-21	Open, Gnd Short
	Rudder Command Crossfeed 2A–	YC2-P1A-50	YC1-P1A-11	Open
	Rudder Command Crossfeed 2BA+	YC2-P1B-40	YC1-P1B-10	Open, Gnd Short
	Rudder Command Crossfeed 2BB+	YC2-P1B-51	YC1-P1B-21	Open, Gnd Short
	Rudder Command Crossfeed 2B–	YC2-P1B-50	YC1-P1B-11	Open
4M	Align Sensor 1A	YC1-P2A-32	YC2-P2A-29	Gnd Short
	Align Sensor 1B	YC1-P2B-32	YC2-P2B-29	Gnd Short
	Align Sensor 2A	YC2-P2A-32	YC1-P2A-29	Gnd Short
	Align Sensor 2B	YC2-P2B-32	YC1-P2B-29	Gnd Short
	Rollout Sensor 1A	YC1-P2A-13	YC2-P2A-11	Gnd Short
	Rollout Sensor 1B	YC1-P2B-13	YC2-P2B-11	Gnd Short
	Rollout Sensor 2A	YC2-P2A-13	YC1-P2A-11	Gnd Short
	Rollout Sensor 2B	YC2-P2B-13	YC1-P2B-11	Gnd Short
	RAD ALT AFCS Valid 1	RA1-P1B-57	PC1-P1A-55	Hot Short
			PC1-P1B-55	Hot Short
			RC1-P1A-57	Hot Short
			RC1-P1B-61	Hot Short
			YC1-P2A-55	Hot Short
			YC1-P2B-55	Hot Short
			SC-P1B-33	Hot Short
	RAD ALT AFCS Valid 2	RA2-P1B-57	PC2-P1A-55	Hot Short
			PC2-P1B-55	Hot Short
			RC2-P1A-57	Hot Short
			RC2-P1B-61	Hot Short
			YC2-P2A-55	Hot Short
			YC2-P2B-55	Hot Short
			SC-P2B-33	Hot Short

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R Indicated Failures Check List
R Figure 601 (Sheet 7)

EFFECTIVITY: ALL

001B

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4N	DLC Limit Hyd Press 1	DS-P1-37	FC-P1A-22	Hot Short
	DLC Limit Hyd Press 2	DS-P2-29	FC-P2A-22	Hot Short
4O	YC-C1 Node 1A	YC1-P2A-48	YC2-P2A-31	Hot Short
	YC-C1 Node 1B	YC1-P2B-48	YC2-P2B-31	Hot Short
	YC-C1 Node 2A	YC2-P2A-48	YC1-P2A-31	Hot Short
	YC-C1 Node 2B	YC2-P2B-48	YC1-P2B-31	Hot Short
	YC-C2 Node 1A	YC1-P2A-49	YC2-P2A-30	Hot Short
	YC-C2 Node 1B	YC1-P2B-49	YC2-P2B-30	Hot Short
	YC-C2 Node 2A	YC2-P2A-49	YC1-P2A-30	Hot Short
	YC-C2 Node 2B	YC2-P2B-49	YC1-P2B-30	Hot Short
	Rudder Mod Piston Engage 1A –	YC1-P2A-41	FP-P1-K	Gnd Short
	Rudder Mod Piston Engage 2A–	YC2-P2A-41	FP-P2-K	Gnd Short
4P	Comparator P2A1	PC1-P1A-10	PC2-P1A-42	Hot Short
	Comparator P2B1	PC1-P1B-10	PC2-P1B-42	Hot Short
	Comparator P2A2	PC2-P1A-10	PC1-P1A-42	Hot Short
	Comparator P2B2	PC2-P1B-10	PC1-P1B-42	Hot Short
	Alt Rate Equal 1+	PC1-P1B-56	PC2-P1B-26	Short Between Signals
	Alt Rate Equal 2+	PC2-P1B-56	PC1-P1B-26	Short Between Signals
	PC No First Failure 1	PC1-P2B-61	RC1-P2B-37	Hot Short
	PC No First Failure 2	PC2-P2B-61	RC2-P2B-37	Hot Short
4Q	Comparator R2A1	RC1-P2A-65	RC2-P2A-18	Hot Short
	Comparator R2B1	RC1-P2B-65	RC2-P2B-18	Hot Short
	Comparator R2A2	RC2-P2A-65	RC1-P2A-18	Hot Short
	Comparator R2B2	RC2-P2B-65	RC1-P2B-18	Hot Short
4R	A/T Override A	FP-P1-ZZ	SC-P1A-43	Open
	A/T Override B	FP-P2-ZZ	SC-P2A-43	Open
	Inhibit Autotrim 1	PC1-P2B-48	TA-P1B-46	Hot Short
	Inhibit Autotrim 2	PC2-P2B-48	TA-P2B-48	Hot Short

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R Indicated Failures Check List
R Figure 601 (Sheet 8)

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4R (Cont)	Autopilot CMD Mode 1	PC1-P2A-44	TA-P1B-03	Open
	Autopilot CMD Mode 2	PC2-P2A-44	TA-P2B-03	Open
	A/L Track 1A	RC1-P2A-56	TA-P1A-34	Open, Gnd Short
			FC-P1A-38	Gnd Short
			PC1-P2A-26	Gnd Short
			YC1-P2A-27	Gnd Short
			YC2-P2A-07	Gnd Short
	A/L Track 1B	RC1-P2B-56	TA-P1B-36	Open, Gnd Short
			FC-P1B-35	Gnd Short
			PC1-P2B-26	Gnd Short
			YC1-P2B-27	Gnd Short
			YC2-P2B-07	Gnd Short
	A/L Track 2A	RC2-P2A-56	TA-P2A-34	Open, Gnd Short
			FC-P2A-38	Gnd Short
			PC2-P2A-26	Gnd Short
			YC1-P2A-07	Gnd Short
			YC2-P2A-27	Gnd Short
	A/L Track 2B	RC2-P2B-56	TA-P2B-36	Open, Gnd Short
			FC-P2B-35	Gnd Short
			PC2-P2B-26	Gnd Short
			YC1-P2B-07	Gnd Short
			YC2-P2B-27	Gnd Short
4S	Roll GA ENG + A/L TRK 1A	RC1-P1A-16	RC2-P1A-13	Open, Gnd Short
	Roll GA ENG + A/L TRK 1B	RC1-P1B-16	RC2-P1B-13	Open, Gnd Short
	Roll GA ENG + A/L TRK 2A	RC2-P1A-16	RC1-P1A-13	Open, Gnd Short
	Roll GA ENG + A/L TRK 2B	RC2-P1B-16	RC1-P1B-13	Open, Gnd Short

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R Indicated Failures Check List
R Figure 601 (Sheet 9)

EFFECTIVITY: ALL

001B

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4S (Cont)	Pitch GA ENG + A/L TRK 1A	PC1-P2A-43	PC2-P2A-54	Open, Gnd Short
	Pitch GA ENG + A/L TRK 1B	PC1-P2B-43	PC2-P2B-54	Open, Gnd Short
	Pitch GA ENG + A/L TRK 2A	PC2-P2A-43	PC1-P2A-54	Open, Gnd Short
	Pitch GA ENG + A/L TRK 2B	PC2-P2B-43	PC1-P2B-54	Open, Gnd Short
4T	Go Around Mode Engaged 1A	PC1-P2A-45	RC1-P2A-34 YC1-P2A-19 SC-P1B-34 FC-P1A-53	Short Between Signals
	Go Around Mode Engaged 1B	PC1-P2B-45	RC1-P2B-34 YC2-P2A-16 SC-P1B-43 FC-P1B-3	Short Between Signals
	Go Around Mode Engaged 2A	PC2-P2A-45	RC2-P2A-34 YC2-P2A-19 SC-P2B-34 FC-P2A-53	Short Between Signals
	Go Around Mode Engaged 2B	PC2-P2B-45	RC2-P2B-34 YC1-P2A-16 SC-P2B-43 FC-P2B-3	Short Between Signals

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R Indicated Failure Check List
R Figure 601 (Sheet 10)

PARA.	FUNCTION	FROM	TO	FAULTS DETECTED
4U	Flap Logic (30 Deg) 1A	FS1-P1-28	PC1-P2A-37	Hot Short
			YC1-P2A-25	Hot Short
	Flap Logic (30 Deg) 1B	FS1-P1-27	PC2-P2B-37	Hot Short
			YC2-P2B-25	Hot Short
	Flap Logic (30 Deg) 2A	FS2-P1-28	PC2-P2A-37	Hot Short
			YC2-P2A-25	Hot Short
	Flap Logic (30 Deg) 2B	FS2-P1-27	PC1-P2B-37	Hot Short
			YC1-P2B-25	Hot Short

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R Indicated Failures Check List
Figure 601 (Sheet 11)

EFFECTIVITY: ALL

001B

AUTOPILOT FLIGHT DIRECTOR SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practice
22-15-00	Yaw Stability Augmentation System - Adjustment and Test
22-17-00	Flight Control Electronics System - Adjustment and Test
22-31-00	Speed Control System - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-00	Ram Air Turbine System - Maintenance Practices
31-22-00	Aural Warning Unit - Adjustment and Test
32-63-00	Air/Ground Sensing System - Adjustment and Test
34-14-00	Central Air Data Computer System - Adjustment and Test
34-21-00	Attitude Reference System - Adjustment and Test
34-22-00	Magnetic Heading Reference System - Adjustment and Test
34-32-00	Radio Altimeter System - Adjustment and Test
34-33-00	Instrument Landing System - Adjustment and Test
34-55-00	VOR System - Adjustment and Test

2. Equipment and Materials

VOR/ILS Ramp Test Set T-30, or equivalent

3. Adjustment/Test

The autopilot flight director system operational test provided below requires that all autoflight system components and associated equipment are installed and operational.

A. Preparation

WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Turn on electrical power (Ref. 24-41-00).

R (2) Verify that avionics cooling is on (Ref. 21-00-00).

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - PITCH & ROLL (A6)

AFCS MODE IND (B1)

NO. 2 SYSTEMS - PITCH & ROLL(A24)

AFCS MODE IND (B19)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breakers AFCS WARNING - CAPT (K18) and F/O (K19) are closed.

(4) Verify that the following systems are on:

Yaw stability augmentation system (Ref. 22-15-00)

Flight control electronics system (Ref. 22-17-00)

Speed control system (Ref. 22-31-00)

Aileron control system (Ref. 27-11-00)

Horizontal stabilizer control system (Ref. 27-41-00)

Air/ground sensing system (Ref. 32-63-00)

Aural warning unit (Ref. 31-22-00)

Central air data computer system (Ref. 34-14-00)

Attitude reference system (Ref. 34-21-00)

Magnetic heading reference system (Ref. 34-22-00)

Radio altimeter sytem (Ref. 34-32-00)

Instrument landing system (Ref. 34-33-00)

VOR system (Ref. 34-55-00)

On aircraft 025, 026, 028-999,
Inertial Navigation System (Ref. 34-43-00)

(5) On FCES control panel and PFCS monitor/control panel, verify that all switchlights are on (latched in) with no FAIL or PUSH legend annunciated except YAW SAS legends. YAW SAS FAIL legends will be on because no hydraulic power has been applied.

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(6) On pilots overhead circuit breaker panel CB1, open and tag MISC - RAT AUTO DEPLOY (L3) circuit breaker. Install RAT ground safety lock (Ref. 29-21-00).

B. Operational Test

(1) On APFDS ENGAGE panel, set FD switch A to ON. On Captains attitude director indicator (ADI), verify that command bars are in view and are indicating wings level and existing pitch attitude.

(2) Set FD switch B to ON. Verify that First Officers ADI command bars are in view and are indicating wings level and existing pitch attitude.

(3) On HEADING/PITCH MODE command panel, depress VS, ALT, IAS, and MACH switchlights in sequence. Verify the following:

(a) Depressed mode switchlight comes on.

(b) Selected mode is annunciated on Captains and First Officers AFCS MODES annunciator indicators.

(c) Previously selected mode is cancelled.

(4) Depress (engage) VS switchlight.

(5) Rotate VERT SPEED selector in DN direction. Verify that VERT SPEED counter responds, and command bars on both ADI show pitch down command.

(6) Depress (disengage) VS switchlight.

R (7) On aircraft 001-030,
R perform air data computer self test as follows:

R (a) On air data computer (ADC) No. 1, depress and hold
R SELF TEST switch. Verify that VERT SPEED counter
R jumps up to approximately 300 ft and returns to
R zero.

R (b) Release ADC NO. 1 SELF TEST switch.

R (c) On ADC NO. 2, depress and hold SELF TEST switch.
R Verify that VERT SPEED counter jumps up to
R approximately 300 ft and returns to zero.

R (d) Release ADC NO. 2 SELF TEST switch.

R NOTE: Depressing either ADC SELF TEST switch may
R cause an ADC fail latch in the LRS computer
R to set. In FESC, center rack, set LRS
R computer BITE switch to RESET for 5 seconds
R then return to RUN. Verify that ADC fail
R indicator on LRS computer has reset
R (BLACK).

(7) On aircraft 031-999,
R perform ADC self test as follows:

R (a) On both digital air data computers (DADC),
R simultaneously depress PUSH TO TEST switches for 1
R second and release.

R (b) When TEST IN PROGRESS lights on DADC begin to
R flash, simultaneously depress PUSH TO TEST
R switches for 1 second and release.

R (c) Verify that VERT SPEED counter jumps to
R approximately 6000 FPM descent (brown) and begins
R to slew towards zero. The counter will hold for
R approximately 30 seconds at zero, then slew to
R approximately 3500 FPM climb (blue).

R (d) Terminate test by simultaneously depressing PUSH
R TO TEST switches and releasing when counter slews
R to approximately 3500 FPM climb (blue).

R NOTE: When self test is performed using one DADC,
R the circuit breaker for the other DADC must
R be pulled. Pull CB1-G27 when testing
R system 1 and CB1-G8 when testing system 2.

R (8) On HEADING/PITCH MODE command panel, depress HDG
switchlight. Verify that HDG switchlight is on, and

AFCS MODES annunciator indicators are displaying HDG SEL.

R (9) Set HEADING counter to horizontal situation indicator (HSI) lubber line heading. Verify that command bars on both ADI are level.

R (10) Turn HEADING selector knob counterclockwise. Verify that ADI command bars command left roll.

R (11) Depress HDG switchlight to off.

R (12) On NAV MODE select panel, ensure that VOR system selector is in SPLIT position.

R (13) Vary each COURSE selector. Verify that associated HSI course pointer is driven to COURSE counter reading.

R (14) If VOR test set is used,
Set up for VOR test as follows:

(a) Tune both VOR receivers to 108.0 MHZ (Ref. 34-55-00).

(b) On VOR tester, set HEADING SELECTOR to 0°, 90°, 180° or 270°, whichever is closer to actual aircraft heading.

(c) Set both compasses to DG and slew heading to the heading selected on the VOR tester.

(d) Turn on VOR tester power, and verify that NAV flag is removed on both HSI.

R (14) If local VOR station is used in lieu of the VOR testor,
Set up for VOR test as follows:

(a) Tune both VOR receivers to local active VOR frequency (Ref. 34-55-00).

(b) Set both compasses to DG and slew heading until compass cards indicate heading to local VOR station.

(c) Verify that NAV flag is removed on both HSI.

R (15) Turn each COURSE selector to deviate associated HSI course deviation bar two dots.

R (16) Depress NAV switchlight. Verify that NAV switchlight is on, and AFCS MODES annunciator indicators are displaying VOR ARM.

R (17) Turn either COURSE selectors to reduce HSI (same side) course deviation to zero. Verify that both AFCS MODES annunciator indicator displays are changed from VOR ARM to VOR. Using other COURSE selector, reduce other HSI course deviation to zero. Verify that both HSI COURSE selector pointers indicate same heading as VOR tester HEADING SELECTOR or heading to local active VOR station.

R (18) Set VOR system selector to 1. Verify that VOR messages are replaced by VOR ARM messages on AFCS MODES annunciators. Verify that VOR ARM messages are replaced by VOR messages on AFCS MODES annunciators within one minute. Wait 40 seconds minimum after VOR messages appear, then rapidly turn left COURSE selector to produce a 1-dot steer-right indication on HSI. Verify that command bars on both ADI command right roll within one-minute (ignore the initial command bar motion if any occurs).

R (19) Turn left COURSE selector to produce a 1-dot steer-left indication of HSI. Verify that FD bars on both ADI command left roll within one minute.

R (20) Set VOR system selector to 2. Verify that VOR messages are replaced by VOR ARM messages on AFCS MODES annunciators. Verify that VOR ARM messages are replaced by VOR messages on AFCS MODES annunciators within one minute. Wait 40 seconds minimum after VOR messages appear, then rapidly turn right COURSE selector to establish a 1-dot steer-right indication on HSI. Verify that command bars on both ADI command right roll within one minute (ignore the initial command bar motion if any occurs).

R (21) Turn right COURSE selector to produce a 1-dot steer-left indication on HSI. Verify that FD bars on both ADI command left roll within one minute.

R (22) Return both compasses to MAG.

R (23) Set up ILS test set and tune both ILS receivers to localizer test frequency. Adjust ILS test set for zero LOC deviation on HSI course deviation bar (Ref. 34-33-00).

R (24) On NAV MODE select panel, depress LOC switchlight. Verify the following:

(a) LOC switchlight comes on.

(b) NAV switchlight goes off.

(c) VOR system selector automatically goes to SPLIT position.

(d) On AFCS MODES annunciators, LOC ARM messages are displayed and then change to LOC.

R (25) Depress LOC switchlight to off.

R (26) Adjust ILS test set for a 2-dot deviation of HSI course deviation bar.

R (27) Depress LOC switchlight to on. Verify that AFCS MODES annunciator indicators display LOC ARM.

R (28) Adjust ILS test set for a zero LOC deviation on HSI course deviation bar, and for a zero GS deviation on HSI GS deviation bar. Verify that AFCS MODES annunciator indicator display is changed from LOC ARM to LOC.

R (29) Depress APR switchlight. Verify the following:

(a) APR switchlight comes on.

(b) LOC switchlight goes off.

(c) AFCS MODES annunciator indicators display LOC ARM and GS ARM. LOC ARM and GS ARM change to LOC and GS after capture.

(d) AFCS WARNING indicators display NO FLARE, and in approximately 35 seconds NO ALIGN is displayed.

NOTE: When both roll computers installed in aircraft have Collins SB 38 incorporated, the NO FLARE warning will not be displayed
R in Step 3B(29)(d).

R (30) Depress A/L switchlight. Verify the following:

(a) A/L switchlight comes on.

(b) APR switchlight goes off.

(c) AFCS MODES annunciator indicators display LOC and GS.

(d) AFCS WARNING indicators display NO FLARE, and in approximately 35 seconds NO ALIGN is displayed.

NOTE: When both roll computers installed in aircraft have Collins SB 38 incorporated,

the NO FLARE warning will not be displayed in Step 3B(30)(d).

R (31) Depress A/L switchlight to off. Verify that all mode legends are out of view on AFCS MODES annunciator indicators.

R (32) On ALT SELECT panel, verify that altitude flag is out of view.

R (33) Set NORM-STBY switch to NORM.

R (34) Set ALTITUDE SELECT 1500 feet above barometric altitude indicator reading.

R (35) Depress ARM switchlight. Verify that ARM switchlight is on, and AFCS MODES annunciator indicators display ALT ARM.

R (36) Depress and hold TEST switch. Slowly decrease ALTITUDE SELECT counter reading to barometric altitude indicator reading. Release TEST switch after verifying the following:

(a) ARM switchlight goes off.

(b) ALT switchlight on HEADING/PITCH MODE command panel comes on.

(c) ALT ARM is replaced by ALT on AFCS MODES annunciator indicators.

R (37) On HEADING/PITCH MODE command panel, depress ALT switch light to off.

R (38) On ALT SELECT panel, set NORM-STBY switch to STBY and
R repeat Steps 3B(31) through 3B(34).

R (39) Depress Captains takeoff/go-around switch. Verify that AFCS MODES annunciator indicators display TAKEOFF.

R (40) On APFDS ENGAGE panel, set both FD switches to OFF and back to ON. Verify that TAKEOFF legend is out of view on AFCS MODES annunciator indicators.

R (41) Depress First Officers takeoff/go-around switch. Verify that AFCS MODES annunciator indicators display TAKEOFF.

R (42) On APFDS ENGAGE panel, set both FD switches to OFF and back to ON.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R (43) Turn on hydraulic power (Ref. 29-11-00). Cycle YAW SAS 1 and 2 switchlights to OFF, then on, to remove FAIL legends. Set autopilot engage switch A to CMD. Verify that switch remains in CMD.

R (44) Move Captains control column forward and turn control wheel to the right, then return to neutral. Verify aileron and horizontal stabilizer movements on surface position indicator.

R (45) Set autopilot engage switch A to OFF and B to CMD. Verify that switch remains in CMD.

R (46) Move First Officers control column forward and turn control wheel to the right, then return to neutral. Verify aileron and horizontal stabilizer movements on surface position indicator.

R (47) Depress TURB switchlight. Verify the following:

(a) Autopilot engage switch drops to CWS.

(b) TURB switchlight comes on.

(c) AFCS MODES annunciator indicators display TURB.

(d) Both ADI command bars are biased out of view.

R (48) Depress TURB switchlight. Verify the following:

(a) TURB switchlight goes off.

(b) TURB legend goes out of view on AFCS MODES annunciator indicators.

(c) Both ADI command bars come into view.

R (49) Set autopilot engage switch B to OFF and A to CMD.

R (50) Repeat Steps 3B(47) and 3B(48).

R (51) Depress Captains autopilot disengage switch. Verify the following:

(a) Autopilot engage switch drops to OFF.

(b) AFCS WARNING indicators display AP DISC warning and flashing ALERT switchlight.

(c) Two-second aural warning (wailer tone) is heard.

R (52) Depress Captains autopilot disengage switch again. Verify that warning disappears on AFCS WARNING indicators.

R (53) Set other autopilot engage switch to CMD.

R (54) Repeat Steps 3B(51) and 3B(52) using First Officers autopilot disengage switch.

R (55) On APFDS ENGAGE panel, set both FD switches to OFF.

R (56) In forward electronic service center, verify that fault isolation monitor annunciators on all autoflight system computers are not tripped.

C. Test Completion

(1) Turn off hydraulic power (Ref. 29-11-00).

(2) Turn off electrical power (Ref. 24-41-00).

R AFCS LAMPS AND ANNUNCIATORS - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting AFCS lamps and annunciator faults are included in this section of the manual. The AFCS lamps and annunciator malfunctions detected by the flight crew are normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This code and the flight log book write-up can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Identification

R Table 101 is a list of AFCS lamps and annunciators fault isolation diagrams and schematics. Figure 101 and 102 provide component location for AFCS lamps and annunciator troubleshooting.

R A. General

R AFCS lamps and annunciators fault isolation contains two levels of troubleshooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation trouble shoots a specific AFCS MODES indicator or AFCS WARNING annunciator self TEST problem. System oriented fault isolation (Ref. 22-02-01, Page 501) tests and trouble shoots AFCS lamps and annunciator problems.

R B. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Fault isolation diagrams identify a fault within the AFCS lamps and annunciators by a specific fault number. They also identify and locate the LRUs which can cause the problem. For faults not listed, perform test (Ref. 22-02-01, Page 501) to isolate problem.

R Figures 103 and 104 provide diagnostic steps to isolate the
R fault. The diagnostic steps are in a flow chart form which
R contains complete fault isolation procedures for each fault.
R Action instructions are contained within the blocks of the
R flow chart while the monitored results of the actions are
R outside the blocks. When using the flow charts, it is
R assumed that systems are in the normal operational mode, all
R relevant circuit breakers have been checked, and all
R applicable aircraft operational procedures have been
R accomplished.

R Fault Isolation Diagrams and Schematics List
R TABLE 101

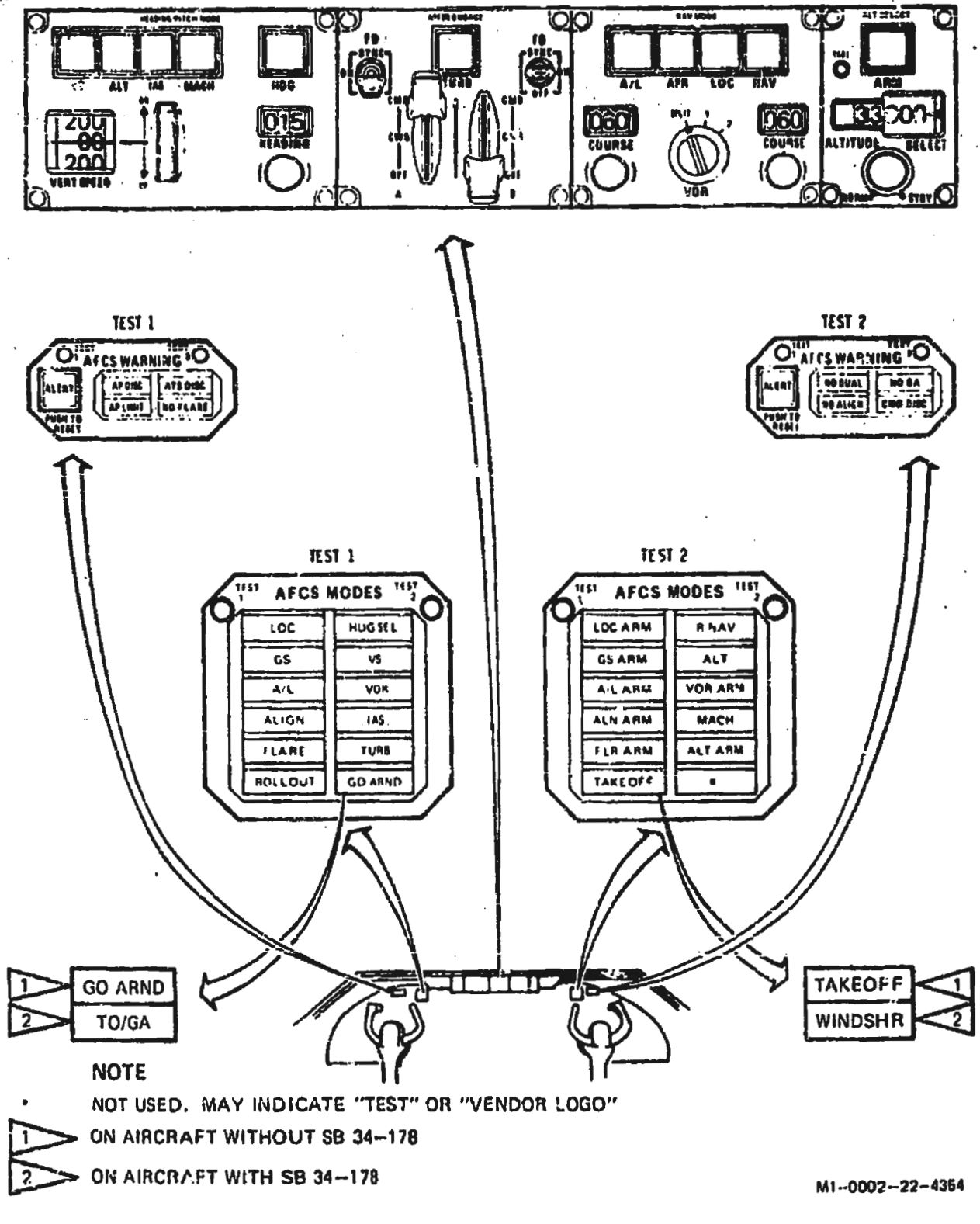
FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	AFCS Modes Annunciator Fault Isolation
104	AFCS Warning Indicator Fault Isolation
105	AFCS Warning Indicator Simplified Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05
INDICATOR – AFCS WARNING	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-06
PANEL – ALTITUDE SELECT	1	FLT STA, GLRSHLD PNL	22-11-03
PANEL – APFDS ENGAGE	1	FLT STA, GLRSHLD PNL	22-10-01
PANEL – HEADING/PITCH MODE COMMAND	1	FLT STA, GLRSHLD PNL	22-10-03
PANEL – NAVIGATION MODE SELECT	1	FLT STA, GLRSHLD PNL	22-10-02
SWITCHLIGHTS – SQUARE (RELAMPING)		FLT STA	20-33-01

M1-0000-72-2092

R R Component Location Index
Figure 101

R R EFFECTIVITY: ALL
0018



NOTE

- NOT USED. MAY INDICATE "TEST" OR "VENDOR LOGO"

1 ON AIRCRAFT WITHOUT SB 34-178

2 ON AIRCRAFT WITH SB 34-178

M1-0002-22-4354

CR
CR

Component Locator Diagram
Figure 102

EFFECTIVITY: ALL

001B

1	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 1, TURB LIGHT DID NOT COME ON BUT DID DURING LIGHT TEST

→ Replace APFDS engage panel (22-10-01)

2	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 1, TURB LIGHT DID NOT COME ON AND DID NOT DURING LIGHT TEST

→ ● Relamp (20-33-01).
● If problem persists, replace APFDS engage panel (22-10-01)

3	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 1, VS OR IAS OR HDG LIGHT DID NOT COME ON BUT DID DURING LIGHT TEST

→ Replace heading/pitch mode panel (22-10-03)

4	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 1, VS OR IAS OR HDG LIGHT DID NOT COME ON AND DID NOT DURING LIGHT TEST

→ ● Relamp (20-33-01).
● If problem persists replace heading/pitch mode panel (22-10-03)

5	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 1, A MESSAGE WAS NOT DISPLAYED

→ Replace AFCS MODES annunciator (22-10-05)

6	CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 1 INOPERATIVE

→ Replace AFCS MODES annunciator (22-10-05)

M1-0001-22-1034

R AFCS Modes Annunciator Fault Isolation
R Figure 103 (Sheet 1)

R EFFECTIVITY: ALL
R
001B

7	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 2, ARM LIGHT DID NOT COME ON BUT DID DURING LIGHT TEST

Replace alt select panel (22-11-03)

8	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 2, ARM LIGHT DID NOT COME ON AND DID NOT DURING LIGHT TEST

- Relamp (20-33-01)
- If problem persists, replace alt select panel (22-11-03)

9	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 2, MACH OR ALT LIGHT DID NOT COME ON BUT DID DURING LIGHT TEST

Replace heading/pitch mode panel (22-10-03)

10	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 2, MACH OR ALT LIGHT DID NOT COME ON AND DID NOT DURING LIGHT TEST

- Relamp 20-33-01).
- If problem persists replace heading/pitch mode panel (22-10-03)

11	DURING CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 2, A MESSAGE WAS NOT DISPLAYED

Replace AFCS MODES annunciator (22-10-05)

12	CAPT (F/O) AFCS MODES ANNUNCIATOR TEST 2 INOPERATIVE

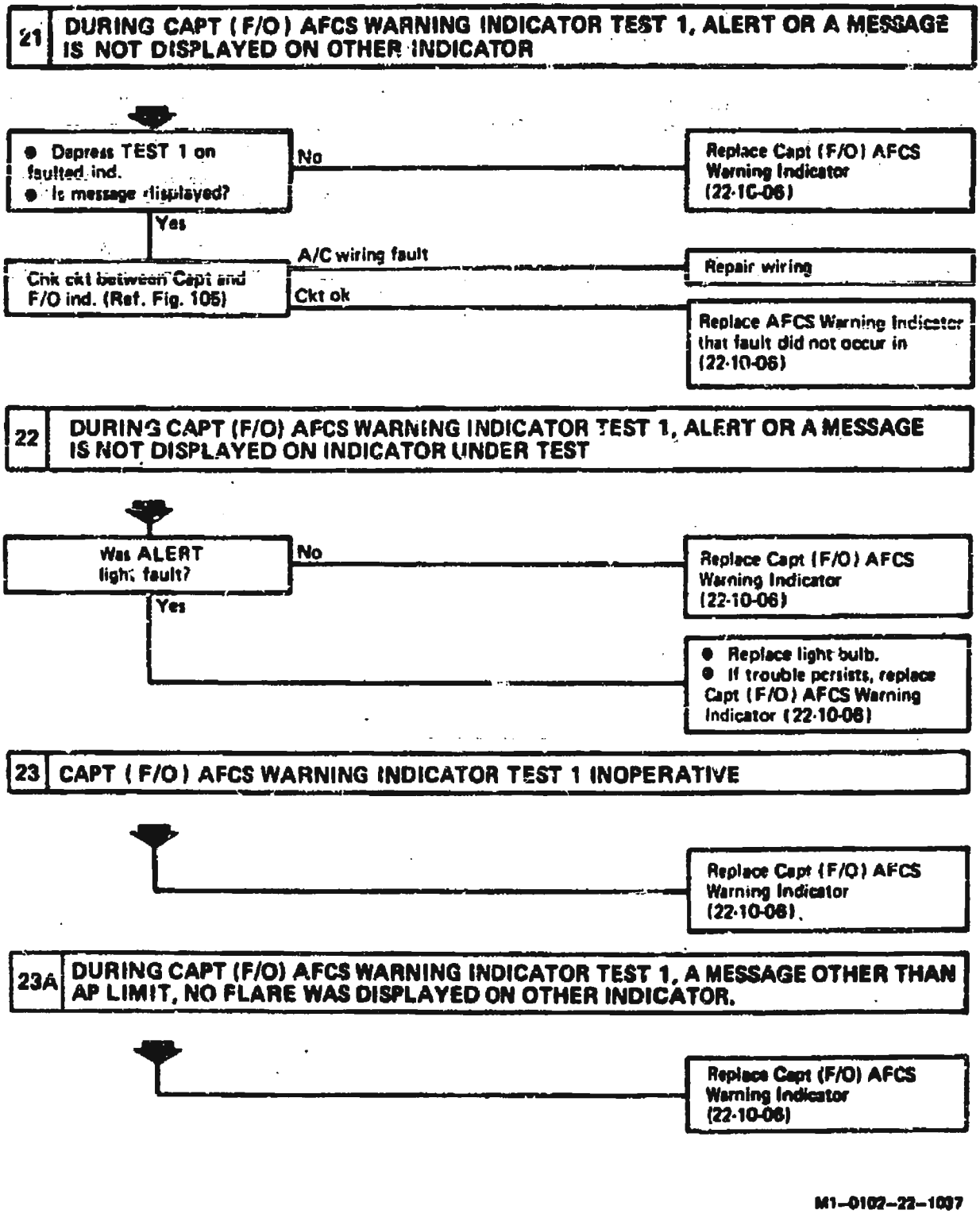
Replace AFCS MODES annunciator (22-10-05)

M1-2001-22-1035

R R AFCS Modes Annunciator Fault Isolation
Figure 103 (Sheet 2)

R R EFFECTIVITY: ALL

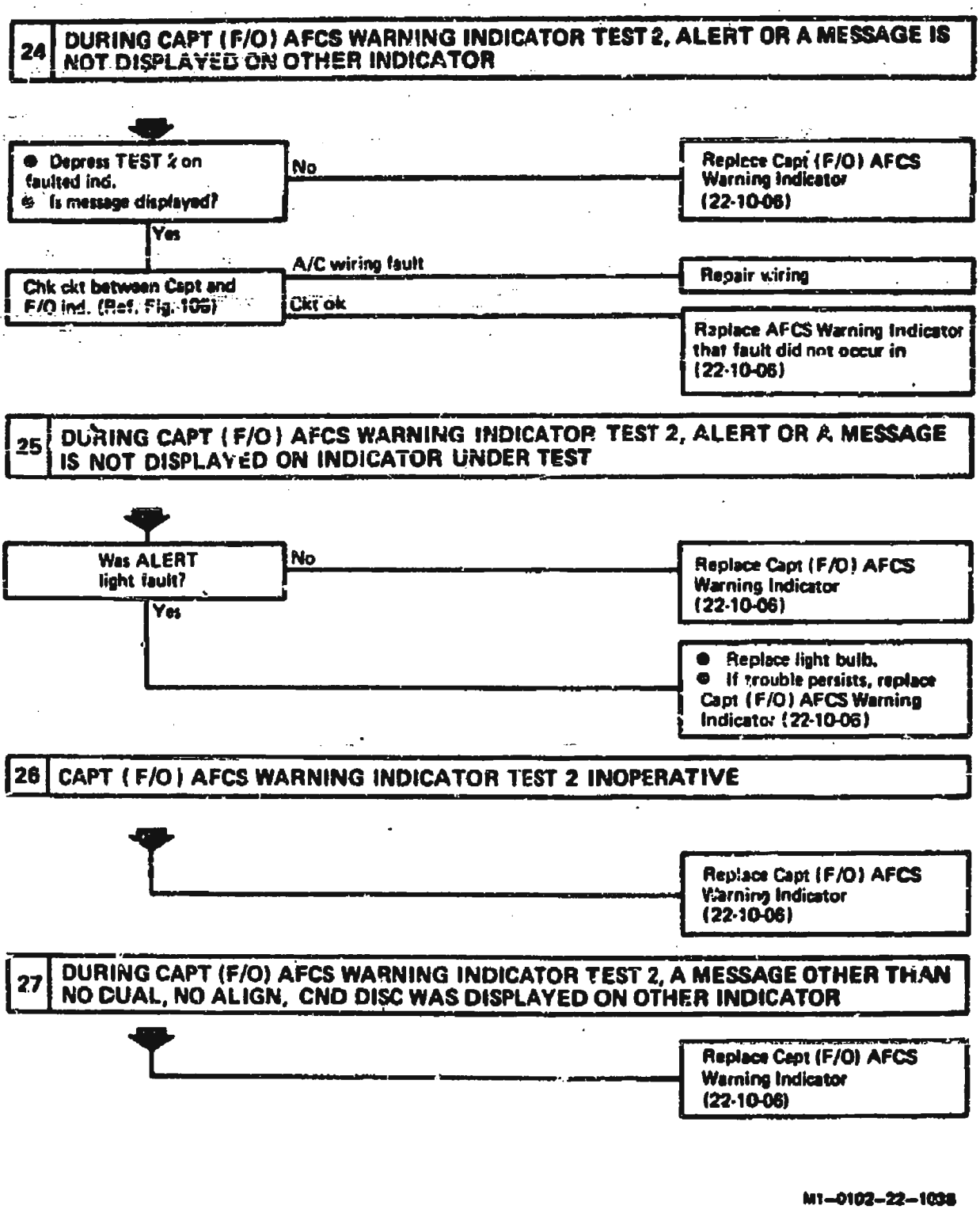
001B


21 DURING CAPT (F/O) AFCS WARNING INDICATOR TEST 1, ALERT OR A MESSAGE IS NOT DISPLAYED ON OTHER INDICATOR
• Depress TEST 1 on faulted ind.
• Is message displayed?
No
Replace Capt (F/O) AFCS Warning Indicator (22-10-06)
Yes
Chk ckt between Capt and F/O ind. (Ref. Fig. 105)
A/C wiring fault
Repair wiring
Ckt ok
Replace AFCS Warning Indicator that fault did not occur in (22-10-06)
22 DURING CAPT (F/O) AFCS WARNING INDICATOR TEST 1, ALERT OR A MESSAGE IS NOT DISPLAYED ON INDICATOR UNDER TEST
Was ALERT light fault?
No
Replace Capt (F/O) AFCS Warning Indicator (22-10-06)
Yes
• Replace light bulb.
• If trouble persists, replace Capt (F/O) AFCS Warning Indicator (22-10-06)
23 CAPT (F/O) AFCS WARNING INDICATOR TEST 1 INOPERATIVE
Replace Capt (F/O) AFCS Warning Indicator (22-10-06).
23A DURING CAPT (F/O) AFCS WARNING INDICATOR TEST 1, A MESSAGE OTHER THAN AP LIMIT, NO FLARE WAS DISPLAYED ON OTHER INDICATOR.
Replace Capt (F/O) AFCS Warning Indicator (22-10-06)

M1-0102-22-1007

AFCS Warning Indicator Fault Isolation
Figure 104 (Sheet 1)

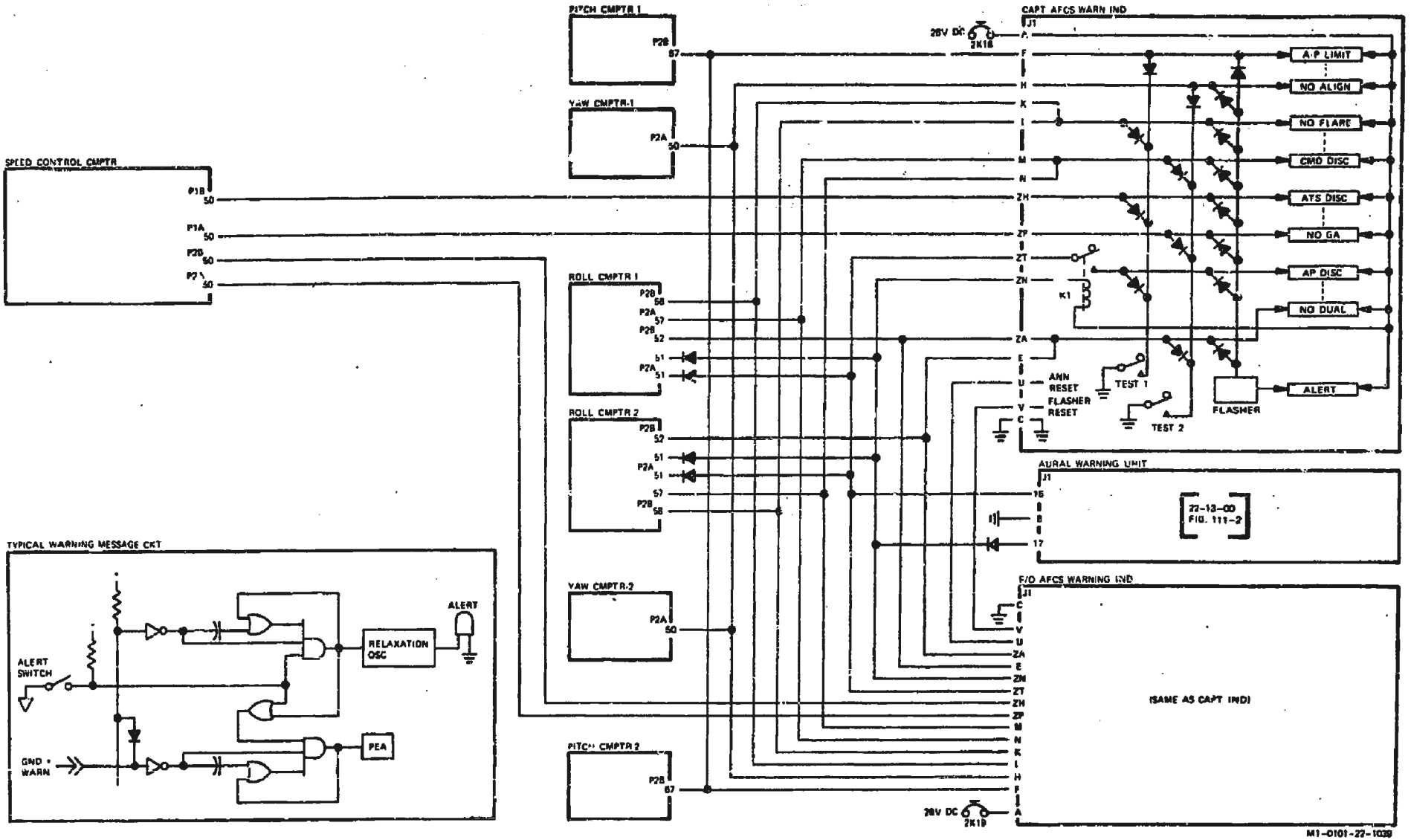
EFFECTIVITY: ALL


24 DURING CAPT (F/O) AFCS WARNING INDICATOR TEST 2, ALERT OR A MESSAGE IS NOT DISPLAYED ON OTHER INDICATOR
● Depress TEST 2 on faulted ind.
● Is message displayed?
No
Replace Capt (F/O) AFCS Warning Indicator (22-10-06)
Yes
Chk ckt between Capt and F/O ind. (Ref. Fig. 105)
A/C wiring fault
Repair wiring
Ckt ok
Replace AFCS Warning Indicator that fault did not occur in (22-10-06)
25 DURING CAPT (F/O) AFCS WARNING INDICATOR TEST 2, ALERT OR A MESSAGE IS NOT DISPLAYED ON INDICATOR UNDER TEST
Was ALERT light fault?
No
Replace Capt (F/O) AFCS Warning Indicator (22-10-06)
Yes
● Replace light bulb.
● If trouble persists, replace Capt (F/O) AFCS Warning Indicator (22-10-06)
26 CAPT (F/O) AFCS WARNING INDICATOR TEST 2 INOPERATIVE
Replace Capt (F/O) AFCS Warning Indicator (22-10-06)
27 DURING CAPT (F/O) AFCS WARNING INDICATOR TEST 2, A MESSAGE OTHER THAN NO DUAL, NO ALIGN, CND DISC WAS DISPLAYED ON OTHER INDICATOR
Replace Capt (F/O) AFCS Warning Indicator (22-10-06)

M1-0102-22-1038

AFCS Warning Indicator Fault Isolation
Figure 104 (Sheet 2)

EFFECTIVITY: ALL



AFCS Warning Indicator Simplified Schematic
Figure 105

EFFECTIVITY: ALL

001B

R AFCS LAMPS AND ANNUNCIATORS - ADJUSTMENT TEST

R 1. General

R The fault detection test procedure in Paragraph 3 is used in
R conjunction with the fault isolation procedure in Paragraph 4.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 4 for appropriate fault isolation.

R 2. Referenced Procedures

R 33-17-00 Annunciator System - Fault Isolation

R 3. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that avionics cooling is on (Ref. 21-00-00).

R (3) On pilots overhead circuit breaker panel CB1, verify
R that the following circuit breakers are closed:

R AFCS MODE IND (B1)

R AFCS MODE IND (B19)

R (4) On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, verify that the following circuit
R breakers are closed:

R CAPT AFCS WARNING (K18)

R F/O AFCS WARNING (K19)

R B. Mode Annunciation

R (1) On pilots overhead LIGHTS panel, depress TEST switch to
R ON.

R (a) On HEADING/PITCH MODE panel, verify that VS, ALT,
R IAS, MACH and HDG lights are on.

R (b) On APFDS ENGAGE panel, verify that TURB light is
R on.

R (c) On NAV MODE panel, verify that A/L, APR, LOC and
R NAV lights are on.

R (d) On ALT SELECT panel, verify that ARM light is on.

R (2) Depress TEST switch to off (dark). Verify that all
R panel switchlights are off (dark).

R (3) On Capt and then F/O AFCS MODES annunciator, depress
R and release TEST 1 switch. Verify that following
R messages are displayed then removed:

LOC	HDG SEL
GS	VS
A/L	VOR
ALIGN	IAS
FLARE	TURB
ROLLOUT	GO ARND

R (4) On Capt and then F/O AFCS MODES annunciator, depress
R and release TEST 2 switch. Verify that following
R messages are displayed while switch is depressed:

LOC ARM	R NAV
GS ARM	ALT
A/L ARM	VOR ARM
ALN ARM	MACH
FLR ARM	ALT ARM
TAKEOFF	TEST

R C. Warning Annunciation

R (1) On Capt and then F/O AFCS WARNING indicator, depress
R and release TEST 1 switch. Verify that following
R messages are displayed while switch is depressed:

Indicator Under Test	Other Indicator
ALERT (Flashes)	ALERT (Flashes)
AP DISC ATS DISC	
AP LIMIT NO FLARE	AP LIMIT NO FLARE

R (2) On Capt and then F/O AFCS WARNING indicator, depress
R and release TEST 2 switch. Verify that following
R messages are displayed while switch is depressed:

Indicator Under Test	Other Indicator
ALERT (Flashes)	ALERT (Flashes)
NO DUAL NO GA	NO DUAL
NO ALIGN CMD DISC	NO ALIGN CMD DISC

R 4. Fault Isolation

R A. General

R Table 501 is a summary of Faults encountered when performing the Fault Detection Test. It also lists the fault number in Paragraph 4B and 4C for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 4 and 4C.

R Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 502. For fault isolation of aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R AFCS Lamps and Annunciator Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
	4B MODE ANNUNCIATION FAULTS	
3B(1)	Switchlights not illuminated	(1)
3B(2)	Switchlights not dark	(2)
3B(3) or 3B(4)-1	Message not displayed on Capt AFCS MODES annunciator	(3)
3B(3) or 3B(4)-2	Message not displayed on F/O AFCS MODES annunciator	(4)
	4C WARNING ANNUNCIATOR FAULTS	
3C(1)	Message fault using TEST switch on Capt AFCS WARNING indicator	(1)
3C(2)	Message fault using TEST switch on F/O AFCS WARNING indicator	(2)

R Schematics for Fault Isolation of AFCS Lamps and Annunciators
R Table 502

TITLE	LOCATION
AFCS Control Panel Lamp and Dimming Schematic	MM 22-00-00, Fig. 105
AFCS Schematic Home Diagram	MM 22-00-00, Fig. 106

R B. MODE ANNUNCIATION FAULTS

R (1) Fault: Switchlights not illuminated

R (a) Are switchlights on all glareshield panels dark?

R Yes: Check for lights control system (ILCB) fault
R (Ref. 33-17-00).

R No: Go to Step (b).

R (b) Are all switchlights on one glareshield panel
R dark?

R Yes: Replace defective panel.

R No: Replace defective switchlight lamps. If
R problem persists, replace defective panel.

R ---

R (2) Fault: Switchlights not dark

R (a) Do all panel switchlights remain illuminated?

R Yes: Check for lights control system (ILCB) fault
R (Ref. 33-17-00).

R No: Go to Step (b).

R (b) Do all switchlights on one panel remain
R illuminated?

R Yes: Replace defective panel.

R No: Go to Step (c).

R (c) Does one AFCS MODES annunciator display a message
R which corresponds to illuminated switchlight?

R Yes: Go to Step (d).

R No: Replace panel where light shows.

R (d) On CB1, open PITCH & ROLL (A6) or (A24) circuit
R breaker associated with the AFCS MODES annunciator
R displaying a message. Is message removed from
R view?

R Yes: Replace (pitch or roll) computer associated
R with the message (Ref. 22-11-01 or 22-13-01).

R No: Go to Step (e).

R (e) Remove pitch or roll computer associated with the
R message. Is message removed from view?

R Yes: Replace (pitch or roll) computer (Ref.
R 22-11-01 or 22-13-01).

R No: Replace the affected AFCS MODES annunciator
R (Ref. 22-10-05).

R ---

R (3) Fault: Message not displayed on Capt AFCS MODES
R annunciator

R (a) Replace Capt AFCS MODES annunciator (Ref.
R 22-10-05).

R ---

R (4) Fault: Message not displayed on F/O AFCS MODES
R annunciator

R (a) Replace F/O AFCS MODES annunciator (Ref.
R 22-10-05).

R ---

R C. WARNING ANNUNCIATION FAULTS

R (1) Fault: Message fault using TEST switch on Capt AFCS
R warning indicator

R (a) Is problem in Capt or F/O indicator or both?

R Capt: Go to Step (b).

R F/O: Go to Step (c).

R Both: Replace Capt AFCS WARNING indicator (Ref.
R 22-10-06).

R (b) Does ALERT switchlight flash?

R Yes: Replace Capt AFCS WARNING indicator (Ref.
R 22-10-06).

R No: Replace switchlight lamps. If problem
R persists, replace Capt AFCS WARNING indicator
R (Ref. 22-10-06).

R (c) Does ALERT switchlight flash?

R Yes: Replace F/O AFCS WARNING indicator (Ref.
R 22-10-06).

R No: Replace switchlight lamps. If problem
R persists, replace Capt AFCS WARNING indicator
R (Ref. 22-10-06).

R ---

R (2) Fault: Message fault using TEST switch on F/O AFCS
R WARNING indicator

R (a) Is problem in Capt or F/O indicator or both?

R Capt: Go to Step (b).

R F/O: Go to Step (c).

R Both: Replace F/O AFCS WARNING indicator (Ref.
R 22-10-06).

R (b) Does ALERT switchlight flash?

R Yes: Replace F/O AFCS WARNING indicator (Ref.
R 22-10-06).

R No: Replace switchlight lamps. If problem
R persists, replace Capt AFCS WARNING indicator
R (Ref. 22-10-06).

R (c) Does ALERT switchlight flash?

R Yes: Replace Capt AFCS WARNING indicator (Ref.
R 22-10-06).

R No: Replace switchlight lamps. If problem
R persists, replace Capt AFCS WARNINC indicator
R (Ref. 22-10-06).

R ----------

R AFCS FIM SYSTEM - DESCRIPTION AND OPERATION

R 1. General

R A. Introduction

R The AFCS FIM (Fault Isolation Monitoring) system
R continuously monitors the AFCS during actual in-flight
R operation and environmental conditions. This enables FIM to
R not only detect static faults, but to also detect and
R indicate dynamic faults which cannot be duplicated by
R maintenance personnel on the ground. Detected faults are
R displayed by magnetic latching fault indicators located on
R the front panels of the 9 AFCS computers. The fault
R indicators may be manually reset and are automatically reset
R at takeoff.

R A white fault indication on a computer, in conjunction with
R an associated flight squawk, indicates that it is faulty and
R should be replaced. A yellow fault indication on the FCES
R computer, in conjunction with an associated flight squawk,
R indicates two types of faults: either (1) an associated
R AFCS LRU (Line Replaceable Unit) is faulty and should be
R replaced; or (2) an associated system is faulty. A black
R indication means the monitored function is good.

R The AFCS FIM system interfaces are shown on Figure 1. The
R interfacing components are as follows:

R 22-10-03 Heading/Pitch Panel

R 22-10-11 AFCS/MLG Accessory Unit

R 22-11-01 Pitch Computer (2)

R 22-11-02 Normal Accelerometer Unit

R 22-11-05 Autopilot Stabilizer Servo

R 22-13-01 Roll Computer (2)

R 22-13-02 Lateral Accelerometer Unit

R 22-15-01 Yaw Computer (2)

R 22-15-02 Yaw Rate Gyro (3)

R 22-17-01 FCES Computer

R 22-18-01 Trim Augmentation Computer

22-31-01 Autothrottle Servo

22-31-03 Thrust Select Panel

22-31-05 Longitudinal Accelerometer Unit

22-31-06 Angle-of-Attack Sensor (2)

22-31-07 Speed Control Computer

27-11-00 Control Wheel (2)

27-11-17 Left Inboard Aileron Servo

27-21-07 Rudder Servo Module

27-41-16 Electrical Feel/Trim Assembly

27-61-06 DLC Servo

32-31-14 Landing Gear Handle (Ref. Fig. 22)

32-31-15 MLG Hydraulic Pressure Switches No. 1 and No. 2 (Landing Gear Control Module) (Ref. Fig. 22)

32-61-08 MLG Truck Unlevel Position Sensor (Ref. Fig. 22)

32-63-01 MLG Air/Ground Safety Sensor

32-63-02 NLG Air/Ground Safety Sensor (Ref. Fig. 22)

33-18-02 Proximity Switch Card Box

33-18-03 Proximity Switch Logic Unit

34-14-01 Air Data Computer (2)

R 34-21-04 Vertical Gyro (3) (on Aircraft 001-024, 027)

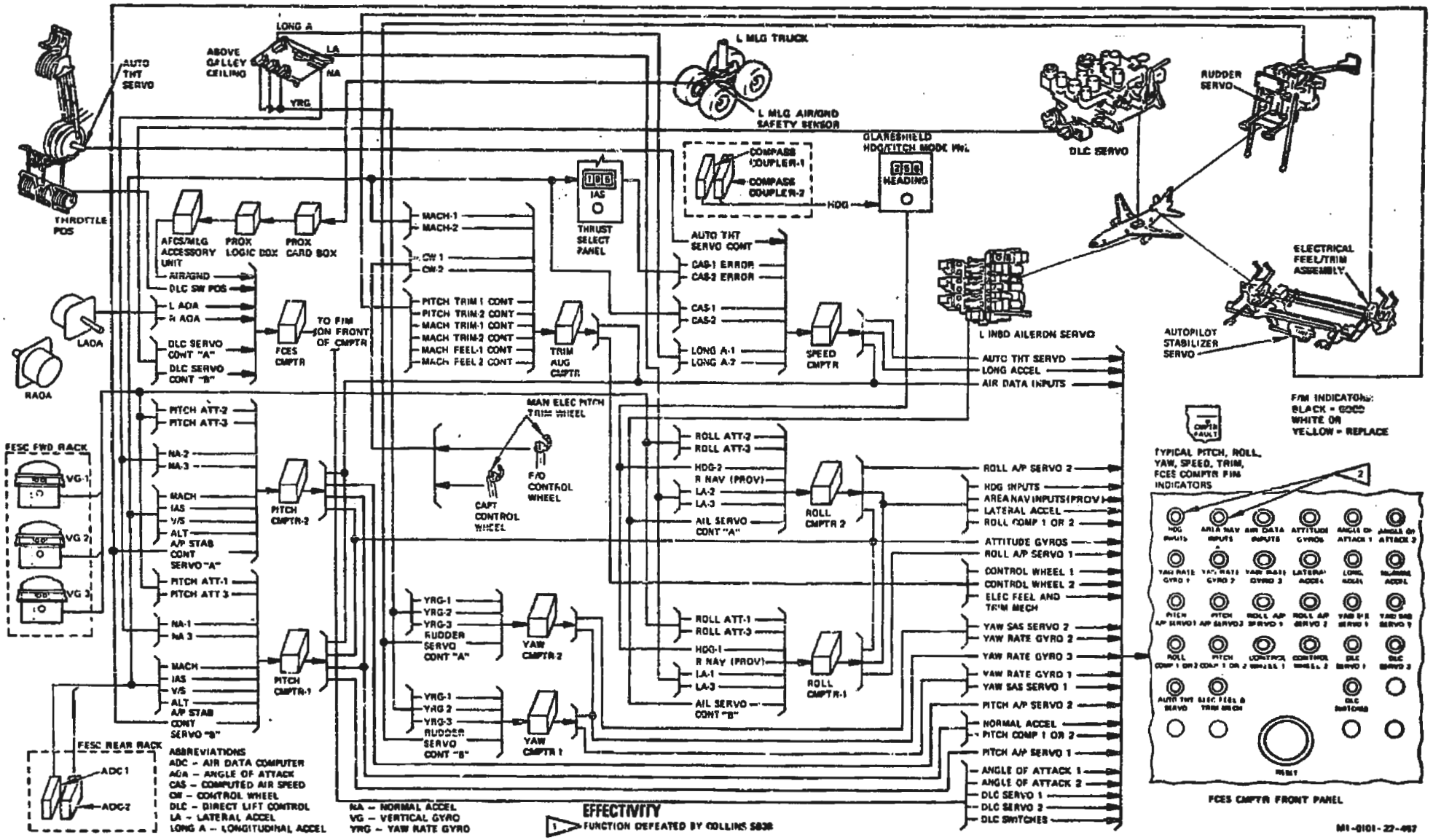
34-22-03 Compass Coupler (2)

R 34-43-03 Inertial Navigation Unit (3) (On aircraft 025,
R 026, 028-999)

76-11-00 Throttle Lever Switches

B. General FIM System Operation (Ref. Fig. 2 and 3)

The FIM system utilizes analog signal comparators to detect faults in:



AFCS FIM System Interface
Figure 1

EFFECTIVITY: ALL

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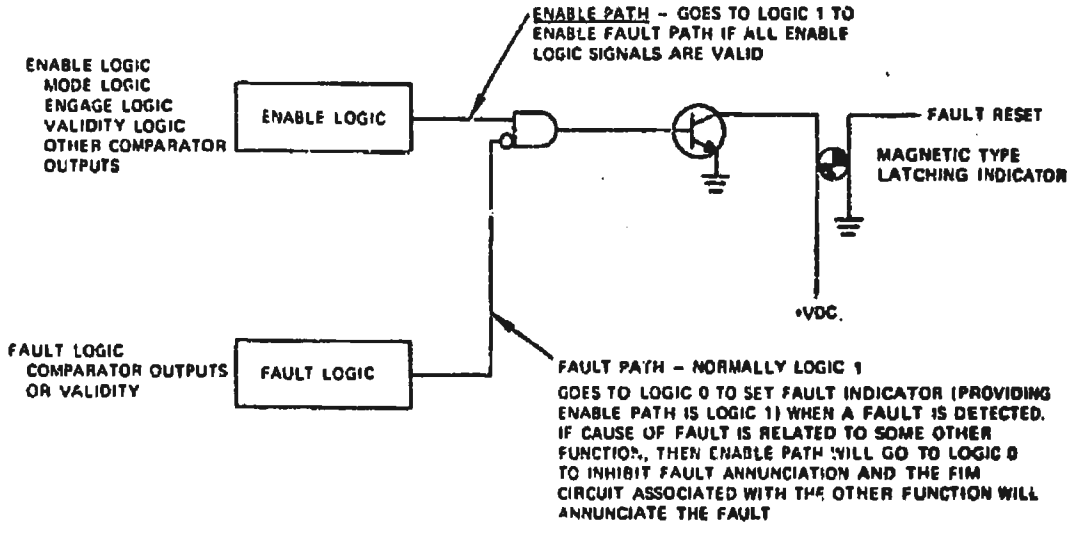
- the sensors which provide basic data for system control
- the computers which process the sensor inputs
- the servos which control the aircraft in response to computed command signals.

If the signal inputs to a comparator disagree by more than a pre-set amount, the comparator transmits a failure indication signal to its associated fault annunciation circuit. A latching FIM indicator will be set if enable logic signal inputs to the annunciation circuit are also present.

Enable logic inputs include flight director, autopilot and mode engagement logic, and validity signals (or comparator output signals) from other components or systems. Engagement logic is used to minimize nuisance fault indications by insuring that the monitored function is being used for aircraft control before a FIM indicator can be set. Validity signals are used to insure that a component fault indicator will not be set as the result of a failure in another component.


ENABLE PATH – GOES TO LOGIC 1 TO ENABLE FAULT PATH IF ALL ENABLE LOGIC SIGNALS ARE VALID
ENABLE LOGIC
MODE LOGIC
ENGAGE LOGIC
VALIDITY LOGIC
OTHER COMPARATOR OUTPUTS
ENABLE LOGIC
FAULT RESET
MAGNETIC TYPE LATCHING INDICATOR
+VDC
FAULT LOGIC
COMPARATOR OUTPUTS OR VALIDITY
FAULT LOGIC
FAULT PATH – NORMALLY LOGIC 1
GOES TO LOGIC 0 TO SET FAULT INDICATOR (PROVIDING ENABLE PATH IS LOGIC 1) WHEN A FAULT IS DETECTED. IF CAUSE OF FAULT IS RELATED TO SOME OTHER FUNCTION, THEN ENABLE PATH WILL GO TO LOGIC 0 TO INHIBIT FAULT ANNUNCIATION AND THE FIM CIRCUIT ASSOCIATED WITH THE OTHER FUNCTION WILL ANNUNCIATE THE FAULT
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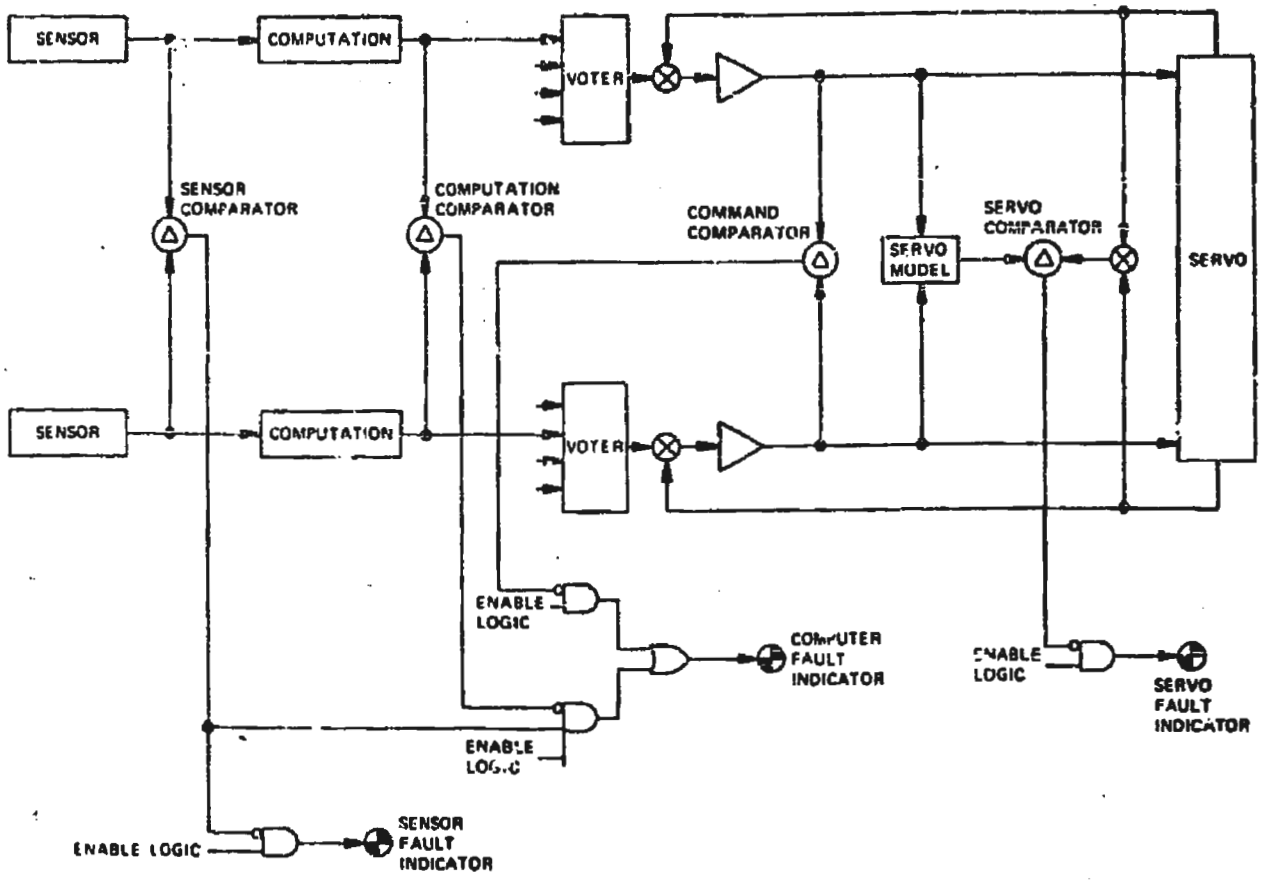
Typical FIM Circuit
Figure 2



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R R General FIM System Operation
Figure 3

R R EFFECTIVITY: ALL

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As indicated in Figure 3, a sensor fault indicator will be set if its comparator is tripped and its associated enable logic is present. Since the downstream computation comparator may also be tripped as a result of the sensor fault, the sensor comparator trip signal is also routed to the computer fault annunciation circuit to inhibit its operation. If the computer comparator is tripped with the sensor comparator not tripped, and other enable logic signals are present, the computer fault indicator will be set. It is not necessary to transmit the sensor and computation comparator trip signals to the command and servo fault annunciation circuits, since the voters automatically select signals in a manner to provide balanced servo commands.

A fault in the voter or servo amplifier circuits, which are located in the computers, will result in a command comparator trip and display of a computer fault indication if all enable logic signals are present. Incorrect response of a servo to command signals with respect to a servo model will cause a servo comparator trip and display of a servo fault indication if all enable logic signals are present. A cross-connect (not shown in Figure 3) is provided between the computer and servo fault annunciation circuits to inhibit the display of a servo fault indicator if a computer fault indicator is set, and vice versa.

C. RESET of FIM Indicators (Ref. Fig. 4)

(1) Manual RESET

All AFCS FIM indicators will reset to the black condition when the RESET pushbutton on the FCES computer front panel is depressed. If the fault condition and enable logic are still present, the FIM indicator(s) will not reset to black.

(2) Automatic RESET

To minimize nuisance FIM indications which are not related to pilot reports of fault conditions, all AFCS FIM indicators are automatically reset to black condition at takeoff. The automatic reset of FIM will only occur during a period when: (1) the FCES computer power supplies are good; (2) two of the three throttle levers are placed in the takeoff position or greater; and (3) the main landing gear logic is then changed from the on-ground state to the in-air state. If the fault condition and enable logic are still present at takeoff, the FIM indicator(s) will not reset to black.

2. Autopilot Flight Director System (APFDS) FIM

A. General

The APFDS FIM system consists of the two roll computers, the two pitch computers and the FCES computer. Table 1 lists the names of the APFDS FIM indicators, their location and the computers controlling them. The basic conditions to enable autopilot (AP) and flight director (FD) FIM operation follows.

- Engagement of flight director switch will activate all FIM indicators listed on Table 1 except the two ROLL A/P SERVO and two PITCH A/P SERVO fault indicators.

- Engagement of either autopilot switch will activate all the FIM indicators listed on Table 1 associated with the side engaged.

The above two conditions simply state that the APFDS must be in use before it is monitored by the FIM system. Two additional interlocks are provided. First, if an autopilot or flight director is engaged and the aircraft is on the ground all AIR DATA INPUTS, ATTITUDE GYROS, AND A/P SERVO fault indications are inhibited. Secondly, even though the autopilot will not stay engaged in the absence of hydraulic power, the bat handle may be raised which activates the servo monitoring. This condition, which can exist on the ground, will set the A/P SERVO fault indicators; therefore, all A/P SERVO fault indications are inhibited while the aircraft is on the ground.

APFDS FIM Indicators
Table 1

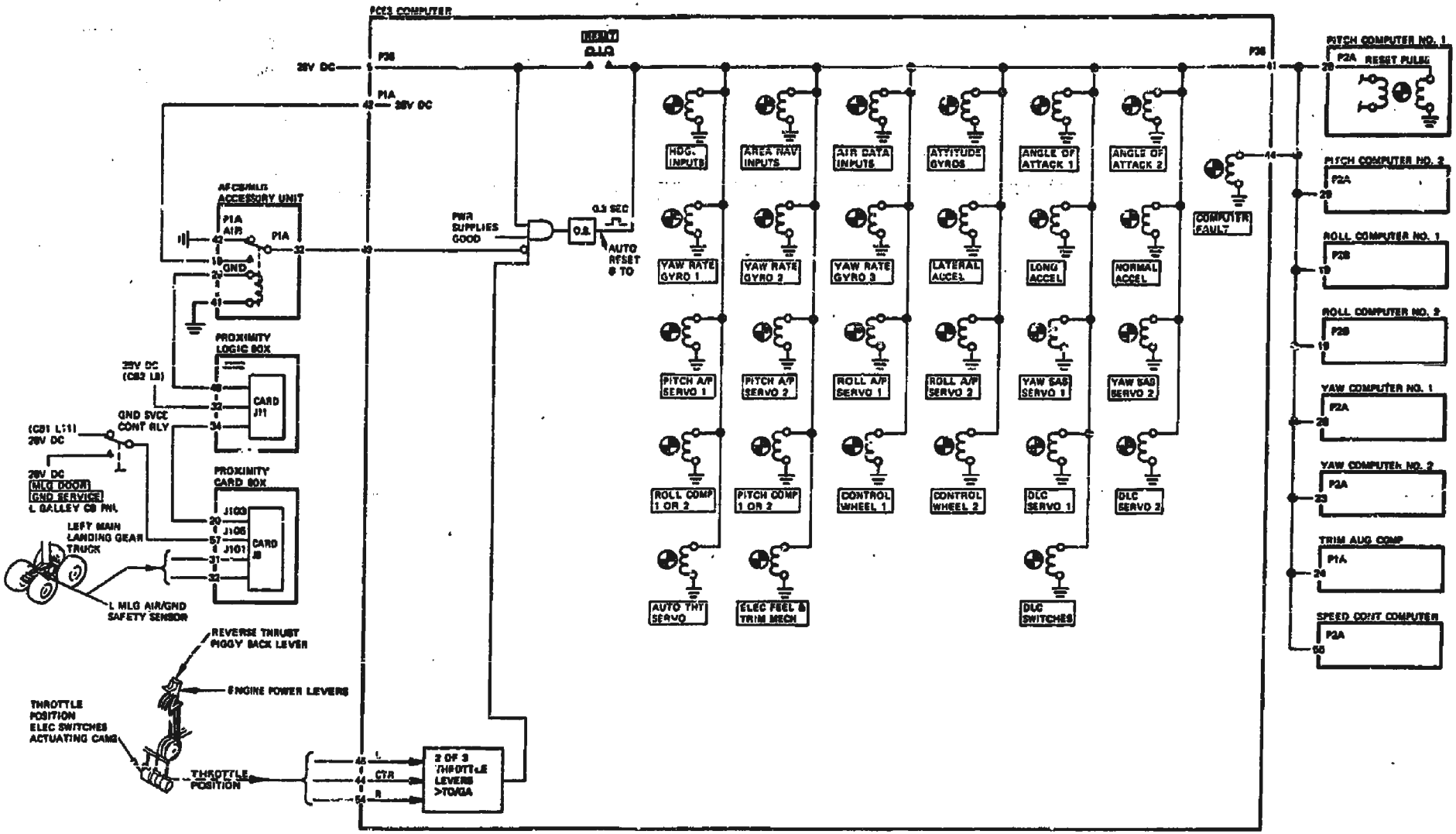
NAME	LOCATION	CONTROLLING COMPUTER(S)			
		ROLL 1	ROLL 2	PITCH 1	PITCH 2
HDG INPUTS (See NOTE)	FCES Computer	X	X	-	-
AREA NAV INPUTS (See NOTE)	FCES Computer	X	X	-	-
AIR DATA INPUTS (See NOTE)	FCES Computer	X	X	X	X
ATTITUDE GYROS	FCES Computer	X	X	X	X

APFDS FIM Indicators (Cont)
Table 1

NAME	LOCATION	CONTROLLING COMPUTER(S)			
		ROLL 1	ROLL 2	PITCH 1	PITCH 2
LATERAL ACCEL	FCES Computer	X	X	-	-
NORMAL ACCEL	FCES Computer	-	-	X	X
PITCH A/P SERVO 1	FCES Computer	-	-	X	-
PITCH A/P SERVO 2	FCES Computer	-	-	-	X
ROLL A/P SERVO 1	FCES Computer	X	-	-	-
ROLL A/P SERVO 2	FCES Computer	-	X	-	-
ROLL COMP 1 or 2	FCES Computer	X	X	-	-
PITCH COMP 1 or 2	FCES Computer	-	-	X	X
COMPUTER FAULT	ROLL Computer No. 1	X	-	-	-
COMPUTER FAULT	ROLL Computer No. 2	-	X	-	-
COMPUTER FAULT	PITCH Computer No. 1	-	-	X	-
COMPUTER FAULT 2	PITCH Computer No. 2	-	-	-	X

APFDS FIM Indicators (Cont)
Table 1

NAME	LOCATION	CONTROLLING COMPUTER(S)			
		ROLL 1	ROLL 2	PITCH 1	PITCH 2
NOTE: TRIM AUG and SPEED CONTROL COMPUTERS ALSO PROVIDE INPUTS. HDG INPUTS and AREA NAV INPUTS functions are defeated by Collins SB38.					



Automatic and Manual RESET of FIM Indications
Figure 4

EFFECTIVITY: ALL

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R B. Pitch Computer FIM System

R There are four basic areas monitored by the pitch computer
R FIM system. They are:

R • sensor signals that provide direct inputs to either
R or both of the pitch computers

R • the redundant computation and power supplies of each
R pitch computer

R • the single channel computation of each computer

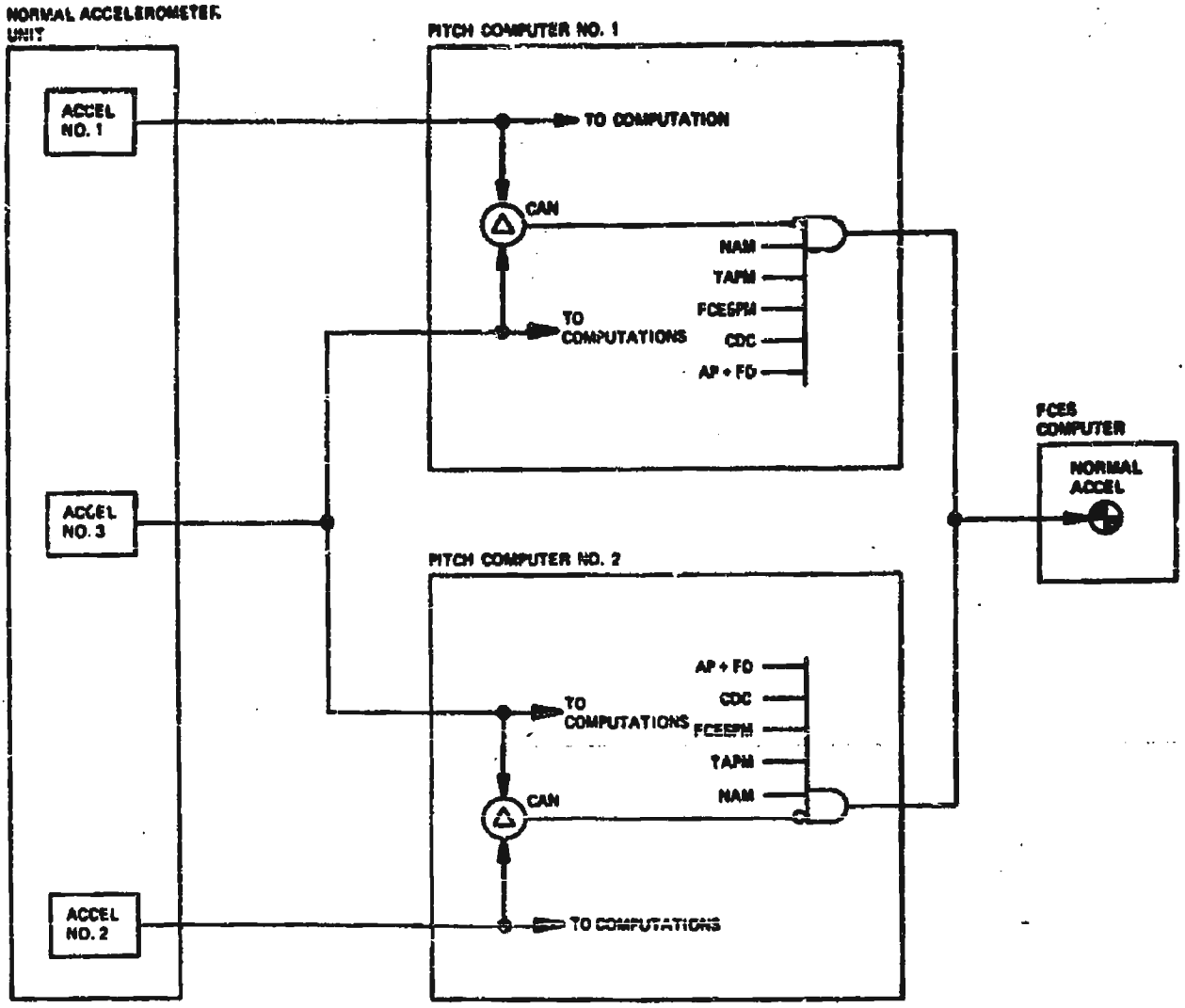
R • the two pitch autopilot servos

R In the case of sensors, it may be seen (Ref. Table 1) that a
R pitch computer can set the AIR DATA INPUTS, ATTITUDE GYROS
R and NORMAL ACCEL fault indicators. A failure in a channel
R of redundant computation or a power supply within a pitch
R computer will be indicated by a COMPUTER FAULT FIM fault
R indication. A failure in a non redundant channel of
R computation will be indicated by the PITCH COMP 1 or 2 FIM
R fault indication. A failure of a pitch servo will be
R indicated by either PITCH A/P SERVO 1 or PITCH A/P SERVO 2
R FIM fault indication.

R (1) NORMAL ACCEL FIM (Ref. Fig. 5)

R (a) Fault Detection

R There are three normal accelerometers mounted in a
R single package. Two are powered by the trim
R augmentation computer and the third is powered by
R the FCES computer. Accelerometer No. 1 is
R connected to channel A of pitch computer No. 1.
R Accelerometer No. 2 is connected to channel A of
R pitch computer No. 2, and accelerometer No. 3 is
R connected to channel B of both pitch computers.
R In this configuration, accelerometers No. 1 and 3
R may be compared in pitch computer No. 1, and
R accelerometers No. 2 and 3 may be compared in
R pitch computer No. 2. It should be noted at this
R point; the comparison of the normal accelerometers
R would be valid even if the normal accelerometer
R unit was completely missing from the aircraft. To
R avoid this situation, an additional monitor
R signals from accelerometers No. 1 and 2 are sent
R to each pitch computer to indicate the normal
R accelerometer unit is installed and connectors
R attached. (The loss of accelerometer No. 3 will
R be detected by the comparison.) Thus with the FIM
R system enabled as described earlier, and the



ABBREVIATIONS:

CAN = NORMAL ACCEL COMPARATOR
CDC = PITCH COMPUTER POWER MONITOR
TAPM = TRIM AUG COMPUTER POWER MONITOR
FCESPM = FCES COMPUTER POWER MONITOR
NAM = NORMAL ACCEL UNIT IS CONNECTED
AP + FD = AUTOPILOT OR FLIGHT DIRECTOR ENGAGED

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Normal Accelerometer FIM
Figure 5

EFFECTIVITY: ALL

pitch, FCES and trim augmentation computer power supplies good, the normal accelerometer unit connected and operating normally; the NORMAL ACCEL fault indicator will indicate no fault. If a normal accelerometer unit connector is removed or an accelerometer fails, the NORMAL ACCEL fault indicator will show a fault. Conversely, if a power supply fails or the system is not enabled; the NORMAL ACCEL fault indicator will not show a fault.

(b) Enable Logic

See Step 2A, General.

(c) Flight Station Indications.

The following fight station indications may occur as a result of a faulted normal accelerometer:

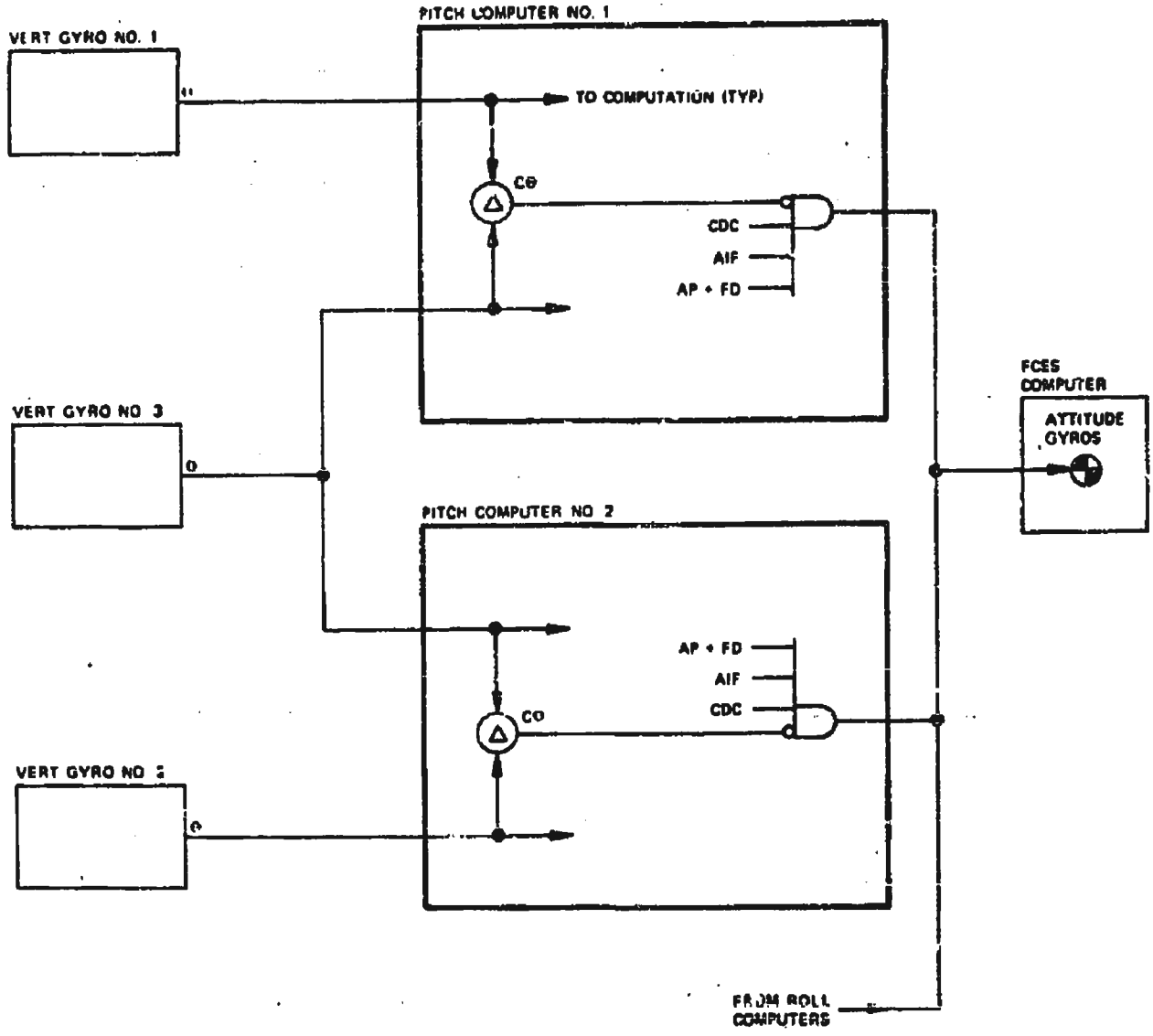
- DUAL A/L NOT AVAIL annunciation on the caution and warning panel.
- NO DUAL warning on AFCS WARNING indicators.
- ATS FAIL lights on overhead FCES control panel with attendent FLT CONTROL PNLS light on caution and warning panel and attendent ATS DISC message on AFCS WARNING indicators.
- AP DISC warning message on AFCS WARNING indicators.

(2) ATTITUDE GYROS (Pitch) FIM (Ref. Fig. 6)

(2) Fault Detection

Three pitch attitude reference signals are connected to the pitch computers in the same manner as the three accelerometers. In pitch computer No. 1, vertical gyro No. 1 and 3 pitch inputs are compared. vertical gyroIn pitch computer No. 2, No. 2 and 3 pitch inputs are compared. To prevent a nuisance ATTITUDE GYROS fault indication due to the difference in gyro erection times, the attitude signals are compared only while airborne.

The ATTITUDE GYROS fault indicator will indicate a fault if either the autopilot or flight director is on, the aircraft is in flight, the pitch computer power supplies are good and a difference



ABBREVIATIONS:
CΘ • PITCH ATTITUDE COMPARATOR
CDC • DC POWER MONITOR
AIF • AIRCRAFT IN FLIGHT
AP • FD • AUTOPILOT OR FLIGHT DIRECTOR ENGAGED

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R Attitude Gyros (Pitch) FIM
R Figure 6

R EFFECTIVITY: ALL
R
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R is detected by one (or both) of the two pitch
R attitude sensor comparators.

R (b) Enable Logic

R See Step 2A, General.

R (c) Flight Station Indications.

R The following flight station indications may occur
R as a result of faulted pitch attitude input
R signals:

R • ADI Displays - Differences between the
R Captains and First Officers flight director
R pitch command bars during basic flight mode
R may be caused by a faulted attitude input
R signal.

R • AP DISC warning message on AFCS WARNING
R indicator.

R • DUAL A/L NOT AVAIL annunciation on caution
R and warning panel.

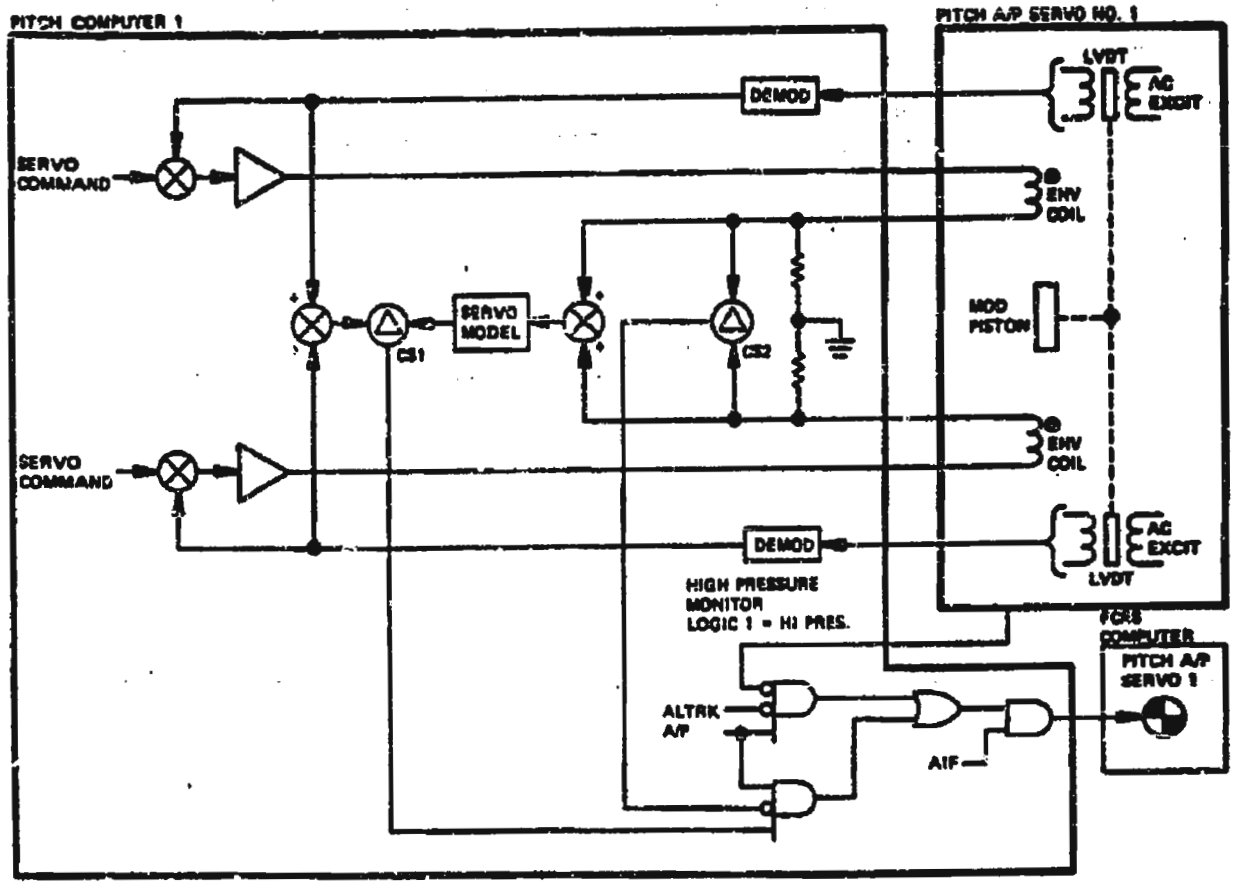
R • NO DUAL warning message on AFCS WARNING
R indicator.

R (3) PITCH A/P SERVO 1 and 2 FIM (Ref. Fig. 7)

R (a) Fault Detection

R The PITCH A/P SERVO fault indicator denotes
R failures in more than just the servo. Failures in
R pitch computer servo amplifier electronics, servo
R position feedback LVDT as well as failure in the
R servo valve will be indicated by the PITCH A/P
R SERVO fault indicator. The failure rate of the
R servo and LVDTS is greater than that of the few
R electronic components in the servo amplifier.
R Thus, when the PITCH A/P SERVO fault indicator is
R tripped, the servo is usually at fault.

R The servo and servo amplifier is monitored in two
R ways; first, the feedback is compared with the
R command and, secondly, the sum of the current in
R the two EHV coils is compared to a constant. If
R an error is detected by CS2, indicating a servo
R amplifier failure, the PITCH A/P SERVO fault
R indicator is inhibited. If, however, CS2 is valid
R and CS1 detects a fault, the fault indicator will
R set. Also since the high authority hook force is



ABBREVIATIONS.
A/P = AUTOPILOT ENGAGED
ALTRK = APPROACH LAND TRACK ENGAGED
CS1 = SERVO COMPARATOR
CS2 = COMMAND COMPARATOR
A/F = AIRCRAFT IN FLIGHT

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Pitch A/P Servo FIM
Figure 7

EFFECTIVITY: ALL

controlled within the servo package, a fault will be indicated if the high authority hook is engaged during a cruise mode (i.e. not in AUTOLAND track).

Servo faults will not be set when the aircraft is on the ground or when the autopilot is not engaged.

(b) Enable Logic

See Step 2A, General.

(c) Flight Station Indications.

The following flight station indications may occur as a result of a faulted autopilot pitch servo:

- AP DISC warning message on the AFCS warning indicators.
- NO DUAL warning message on the AFCS warning indicators if the fault occurs after dual A/L TRK has been established.
- DUAL A/L NOT AVAIL annunciation on caution and warning panel.

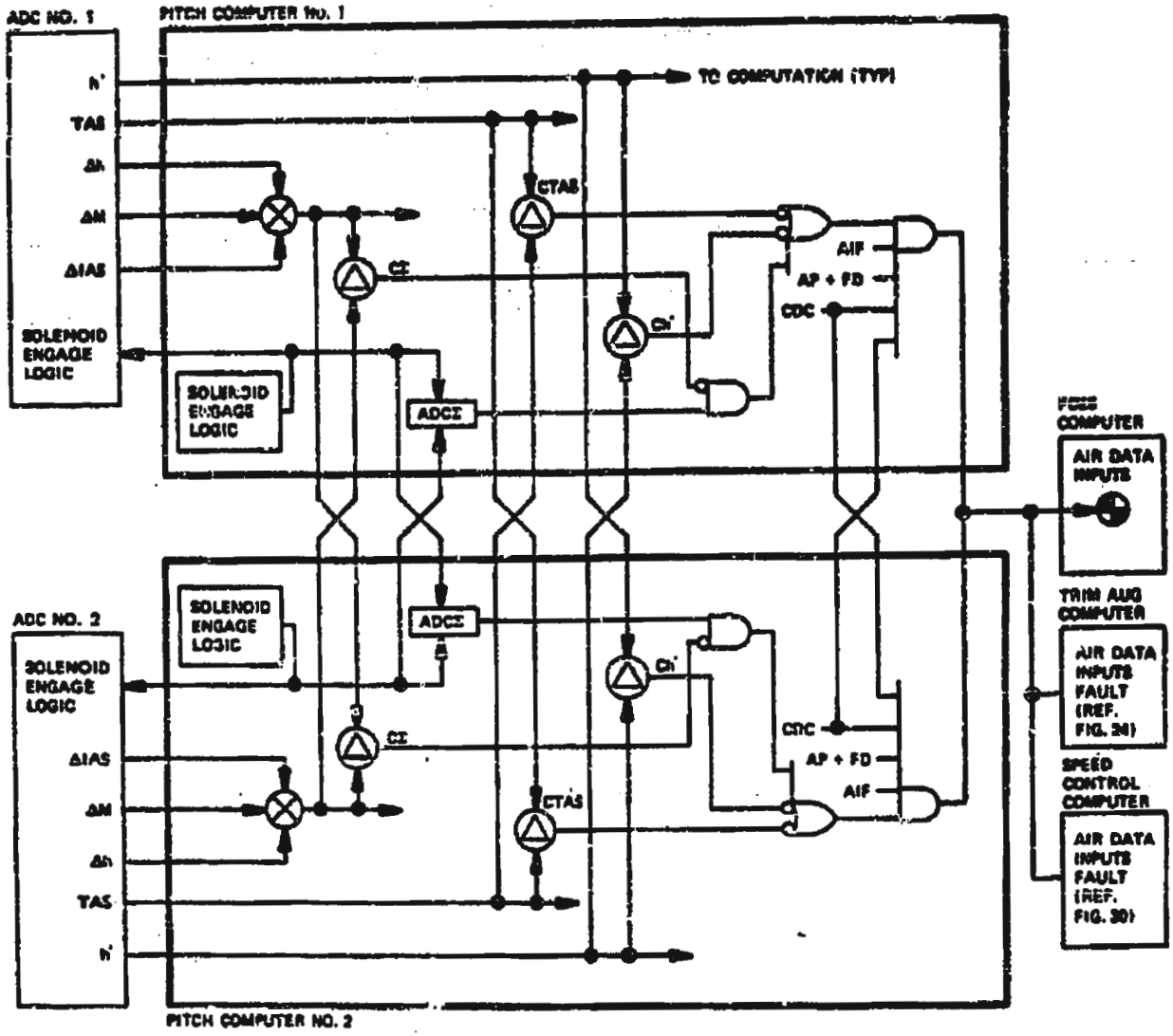
(4) AIR DATA INPUTS (Pitch) FIM (Ref. Fig. 8)

(a) Fault Detection

The AIR DATA INPUTS (MACH Hold, IAS Hold, ALT Hold, Vertical Rate and TAS) used by the pitch computers are monitored by comparing the signal in one computer to the same signal in the other computer. Figure 8 shows this cross computer monitoring. Since both computers are involved, both power supplies must be good and one autopilot or flight director engaged for a valid comparison. If the hold solenoid logic comparison (ADE) is valid and a hold mode is engaged in both computers, the comparison (CE) of the two analog signals is made. If a difference is detected, the AIR DATA INPUTS fault indicator will be set. Additionally, if a difference between the two TAS or Vertical Rate Signals (CTAS and CH dot) is detected, the fault indicator will set.

(b) Enable Logic

See Step 2A, General.



ABBREVIATIONS:

CTAS = TAS COMPARATOR
Ch' = VERT RATE COMPARATOR
CΣ = ALT, MACH, IAS COMPARATOR
ADCΣ = SOLENOID MONITOR
AIF = AIRCRAFT IN FLIGHT
CDC = DC POWER MONITOR
AP + FD = AUTOPILOT OR FLIGHT DIRECTOR ENGAGED

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R
R Air Data Input (Pitch) FIM
Figure 8

R EFFECTIVITY: ALL
R
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R (c) Flight Station Indications.

R The following flight station indications may occur
R as a result of faulted air data input signals:

R • ADI Displays - Difference between the
R Captains and First Officers flight director
R pitch command bars during
R Mach/Altitude/Indicated Air Speed Hold modes
R may be caused by a faulted air data input
R signal.

R • Degraded autopilot performance in holding
R altitude, mach or indicated airspeed may be
R caused by a faulted air data input signal.

R (5) PITCH COMP 1 OR 2 FIM (Ref. Fig. 9)

R (a) Fault Detection

R Like the air data monitoring, the PITCH 1 OR 2
R fault indicator will display a pitch failure but
R can not isolate the fault to a specific computer.
R This monitoring is done by comparing one pitch
R computer computation to the other (Ref. Fig. 9).

R If the sensor inputs (AIR DATA INPUTS, ATTITUDE
R GYROS and NORM ACCEL) and both pitch computer
R power supplies are valid, a comparison between the
R two pitch computer computation may be made.

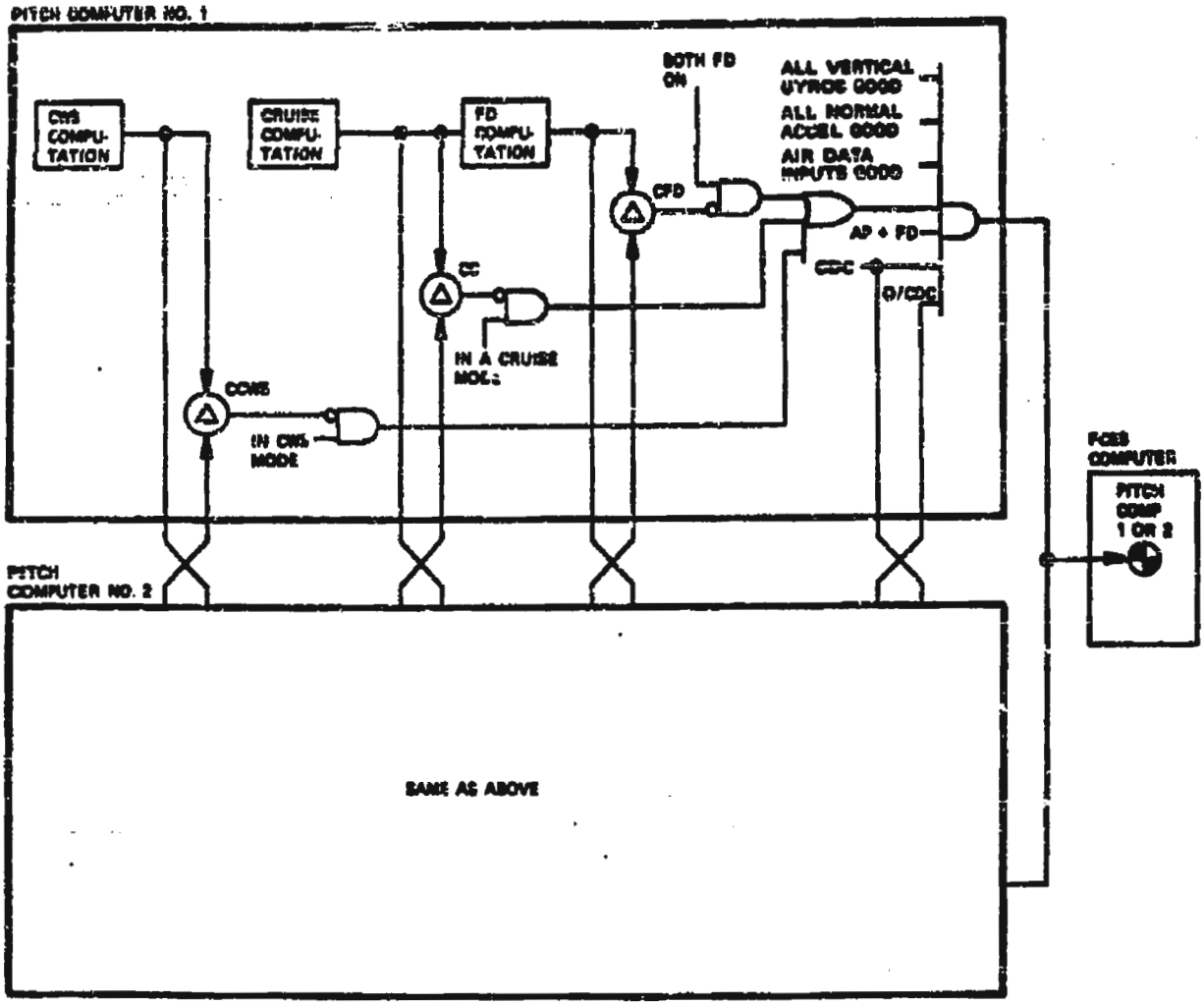
R There are three areas of comparison that will test
R essentially all of the pitch computer computations
R except the AUTOLAND section. First, whenever
R either pitch computer is engaged in a cruise mode
R (not AUTOLAND track), the cruise computations are
R monitored.

R Secondly, the control wheel steering computations
R are compared when in the CWS mode. Third, when
R both flight directors are on, a comparison of the
R flight director command signals is made. Anytime
R a difference is detected in one of the three above
R areas and enable logic is satisfied, a PITCH COMP
R 1 or 2 fault indicator will set.

R (b) Engage Logic.

R See Step 2A, General.

R (c) Flight Station Indications.



ABBREVIATIONS:

CCWS = CONTROL WHEEL STEERING COMPARATOR
CC = CRUISE COMPARATOR
CFD = FLIGHT DIRECTOR COMPARATOR
CDC = DC POWER SUPPLY MONITOR
AP • FD = AUTOPILOT OR FLIGHT DIRECTOR ENGAGED

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R Pitch Computer 1 or 2 FIM
R Figure 9

R EFFECTIVITY: ALL
R
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A fault in pitch computer 1 or 2 may be the cause of the following flight station indications:

• ADI Displays - Differences between the Captains and First Officers flight director pitch command bars may be caused by a fault in one of the two pitch computers.

• APFDS ENGAGE PANEL switches - An autopilot disconnect when pitch force is applied to a control wheel during flight director takeoff mode may be caused by a fault in one of the two pitch computers. An AP DISC warning message will be displayed with AFCS WARNING indicator. • Control Wheel Forces - Lack of response to normal control wheel forces with CWS engaged may be caused by a fault in one of the two pitch computers.

(6) Pitch COMPUTER FAULT FIM (Ref. Fig. 10)

(a) Fault Detection

The AUTOLAND computation is not monitored by the PITCH COMP 1 or 2 fault indicator as described earlier. Since the AUTOLAND computation is dual in each computer, cross-channel monitoring will indicate which pitch computer has failed by setting the fault indicator on the front of the appropriate pitch computer.

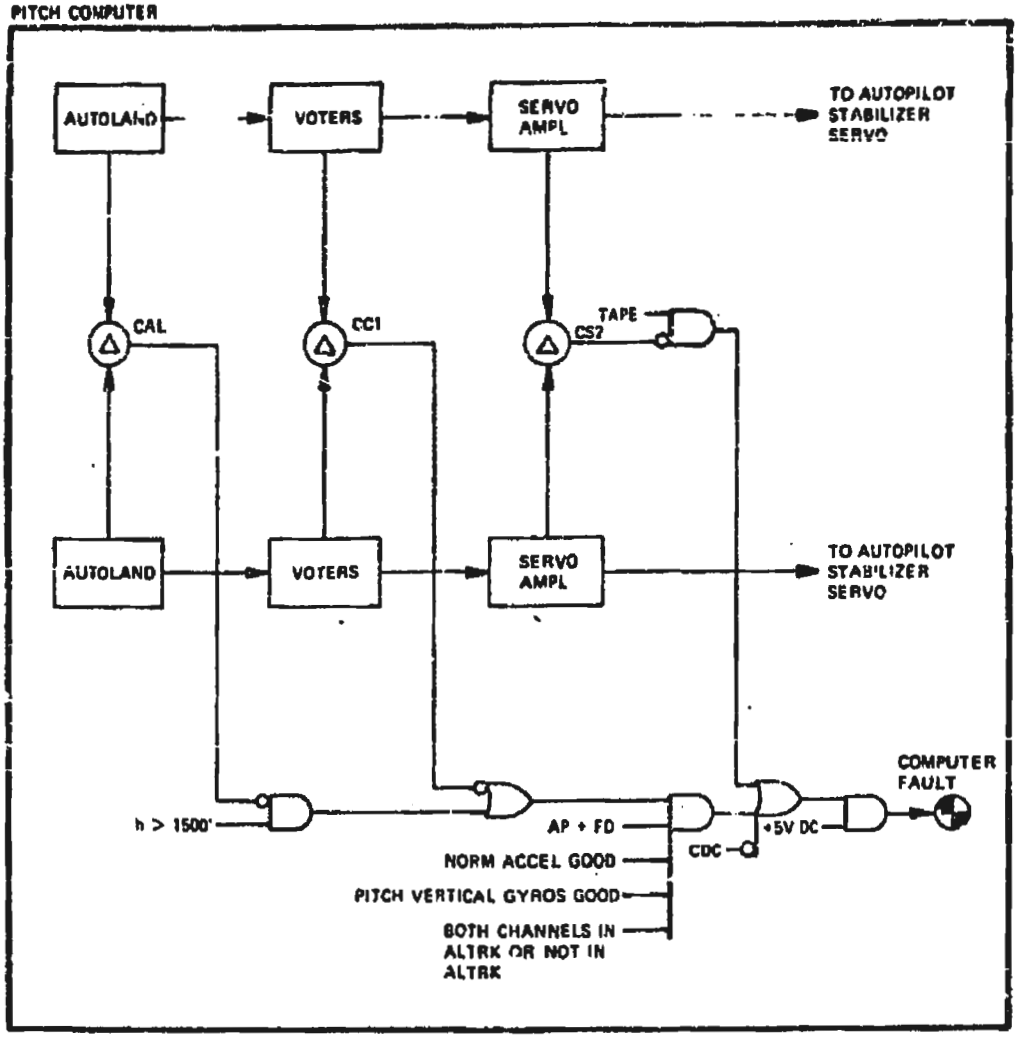
Figure 10 shows three areas monitored in each computer. The AUTOLAND computation is monitored when altitude is greater than 1500 feet. The voters are monitored at all times. The servo amplifier command is monitored when the autopilot is engaged.

Monitoring of the AUTOLAND computation and voters is enabled only after it has been determined that both channels are either in AUTOLAND track or both are in the cruise mode and that the normal accelerometers and vertical gyros are valid and the autopilot or flight director are engaged. A power supply failure will also set a fault indicator.

(b) Engage Logic

See Step 2A, General.

(c) Flight Station Indications.



ABBREVIATIONS:

CAL = AUTOLAND COMPARATOR
CCI = CROSS CHANNEL COMPARATOR
CS2 = SERVO COMPARATOR
h > 1500' = RADIO ALTITUDE GREATER THAN 1500'
AP + FD = AUTOPILOT OR FLIGHT DIRECTOR ENGAGED
TAPE = THIS AUTOPILOT ENGAGAED
CDC = DC POWER MONITOR

EM1-0100-22-478

Pitch Computer FIM
Figure 10

EFFECTIVITY: ALL

0018

The following flight station indications may occur as a result of a faulted pitch computer:

- Flight Director (FD) flag on the respective ADI.

  DUAL A/L NOT AVAIL annunciator on the caution and warning panel.

- AP DISC warning message on the AFCS warning indicators.

- NO DUAL warning message on the AFCS WARNING indicators.

- ATS 1 or 2 FAIL light on the overhead FCES control panel with an attendant FLT CONT PANELS annunciation on the caution and warning panel. In addition, the FAST/SLOW bug on ADI 1 or 2 will be biased out-of-view. These symptoms are related to a pitch computer power supply failure only if the auto-throttle system is in the stall margin mode (i.e., the alpha-flag is in view on the thrust panel).

C. Roll Computer FIM System

(1) HDG INPUTS FIM (Ref. Fig. 11)

R R R On aircraft with roll computers modified by Collins SB38, the HDG INPUTS system FIM circuitry is totally defeated.

(a) Fault Detection

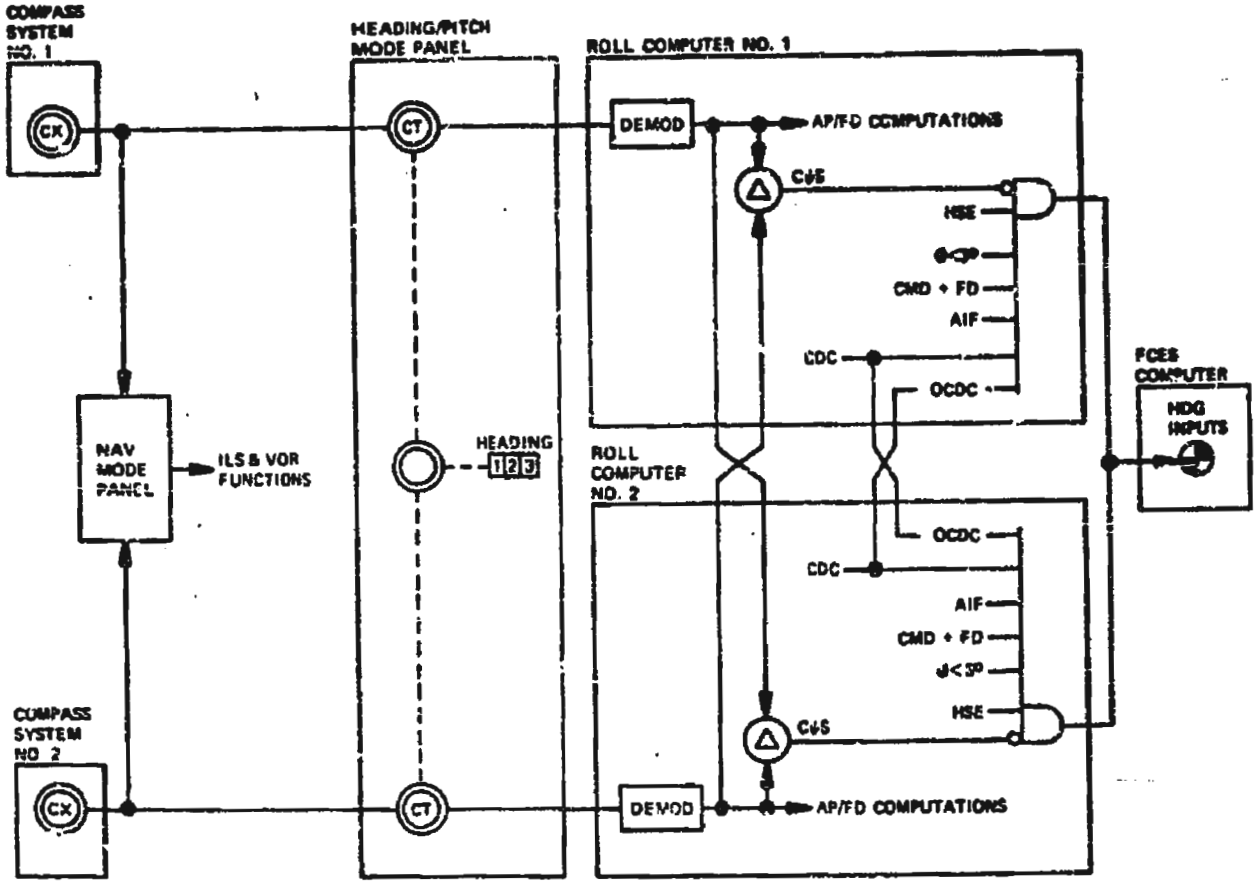
Each compass system transmits a heading signal to the HEADING/PITCH MODE panel. With the compass systems tracking, selection of a new heading on the panel causes identical error signals to be transmitted to roll computers No. 1 and 2. The error signals are then processed by the computers to generate commands for flight director or autopilot control. The error signals are monitored by comparing the signal in one computer with that in the other computer. With the roll computer FIM circuits enabled, a significant difference between the signals will result in the display of the HDG INPUTS fault indication on the FCES computer.

(b) Enable Logic

The HDG INPUTS FIM circuit is enabled when the heading select mode is engaged, the roll attitude is less than 3 degrees, the autopilot is engaged in CMD or the flight director is engaged, the airplane is in flight, and the power supply monitors in both roll computers indicate good. Roll attitude limits of 3 degrees are used to disable the circuits to prevent nuisance fault indications due to compass system differences during turning maneuvers. The power supply monitor signals are cross-connected to prevent a false indication due to a power supply failure in one computer. It should be noted that the FIM circuits can detect that one heading input signal is bad, but not which one. However, each compass system contains fault detection circuits and a fault indicator which can aid in determining which system is faulted.

(c) Flight Station Indications

A compass system fault may be the cause of the following flight station indications:



ABBREVIATIONS.

C&S - FIM HEADING ERROR SIGNAL COMPARATOR
HSE - HEADING SELECT MODE ENGAGED
CMD + FD - AUTOPILOT ENGAGED IN CMD OR FLIGHT DIRECTOR ENGAGED
AIF - AIRCRAFT IN FLIGHT
CDC - DC POWER MONITOR GOOD
OCDC - OTHER DC POWER MONITOR GOOD

EM1-0100-22-470

Heading System FIM
Figure 11

EFFECTIVITY: ALL

001B

- HSI Display - Incorrect bearing, heading and course indications may occur on the HSI associated with a faulted compass system. A detected compass system fault will cause a HDG flag to be displayed on the associated HSI.

- AFCS WARNING Indicator Messages - A difference between heading inputs of more than 6 degrees during operation in the approach/land mode will cause display of a NO ALIGN message on both AFCS WARNING indicators.

- APFDS ENGAGE Panel Switches - An autopilot disconnect may be caused by a fault in the associated compass system.

- ADI Displays - Removal of the flight director command cue(s) from view and display of the FD flag may be caused by a fault in the associated compass system.

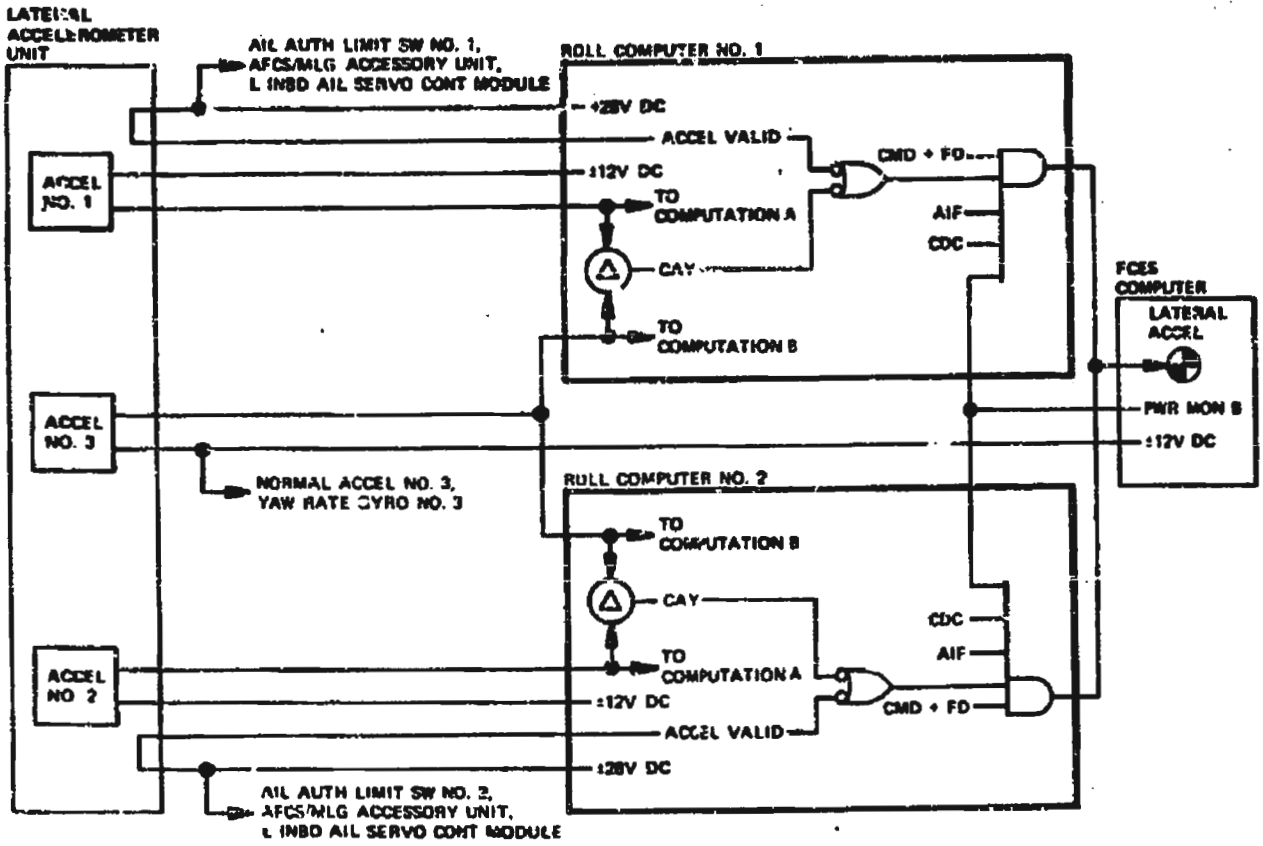
(2) LATERAL ACCEL FIM (Ref. Fig. 12)

(a) Fault Detection

The three lateral accelerometers are contained in a single package. Accelerometers No. 1 and 2 receive ±12V dc excitation from roll computers No. 1 and 2 respectively, while accelerometer No. 3 receives power from the FCES computer.

Output signals from accelerometers No. 1 and 2 are routed to the channel A computation circuits in roll computers No. 1 and 2 respectively, while the output from accelerometer No. 3 is connected to the channel B computation circuits in both roll computers. With the roll computer FIM circuits enabled, a significant difference between accelerometers No. 1 and 3 or between accelerometers No. 2 and 3 will result in the display of a LATERAL ACCEL fault indication on the FCES computer.

Since the FIM and other system comparators would not detect a fault if the accelerometer package were completely disconnected, signal trace wires (accelerometer valids) are routed through the accelerometer No. 1 and 2 connectors to insure that they are connected. With the FIM logic enabled, loss of a valid signal will result in the display of a LATERAL ACCEL fault indication. A trace wire for accelerometer No. 3 is not required



ABBREVIATIONS:

CAY = LATERAL ACCELEROMETER SIGNAL COMPARATOR
CMD + FD = AUTOPILOT ENGAGED IN CMD OR FLIGHT DIRECTOR ENGAGED
AIF = AIRCRAFT IN FLIGHT
CDC = DC POWER MONITOR GOOD
DANA LOGIC = INPUT TO DUAL A/L NOT AVAIL (DANA) LOGIC CIRCUITS

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R
R

Lateral Accelerometer FIM
Figure 12

R
R
001B

EFFECTIVITY: ALL

since with at least two accelerometers connected, the signal comparators will detect a fault. The FIM logic does not identify which of the three accelerometers is faulted, since the entire package must be removed in the event of a single accelerometer fault.

(b) Enable Logic

The LATERAL ACCEL FIM circuit is enabled when the autopilot is engaged in CMD or the flight director is engaged, the airplane is in flight, the roll computer power supply monitor indicates good, and the FCES computer power supply monitor indicates good (since the FCES computer provides accelerometer No. 3 power).

(c) Flight Station Indications

A lateral accelerometer fault may be the cause of the following flight station indications:

- APFDS ENGAGE Panel Switches - An autopilot engage switch drop-off from CMD to CWS during operation in the localizer, approach and approach/land modes may be caused by a lateral accelerometer fault. A CMD DISC message will be displayed on the AFCS WARNING indicators as a result of the drop from CMD to CWS.

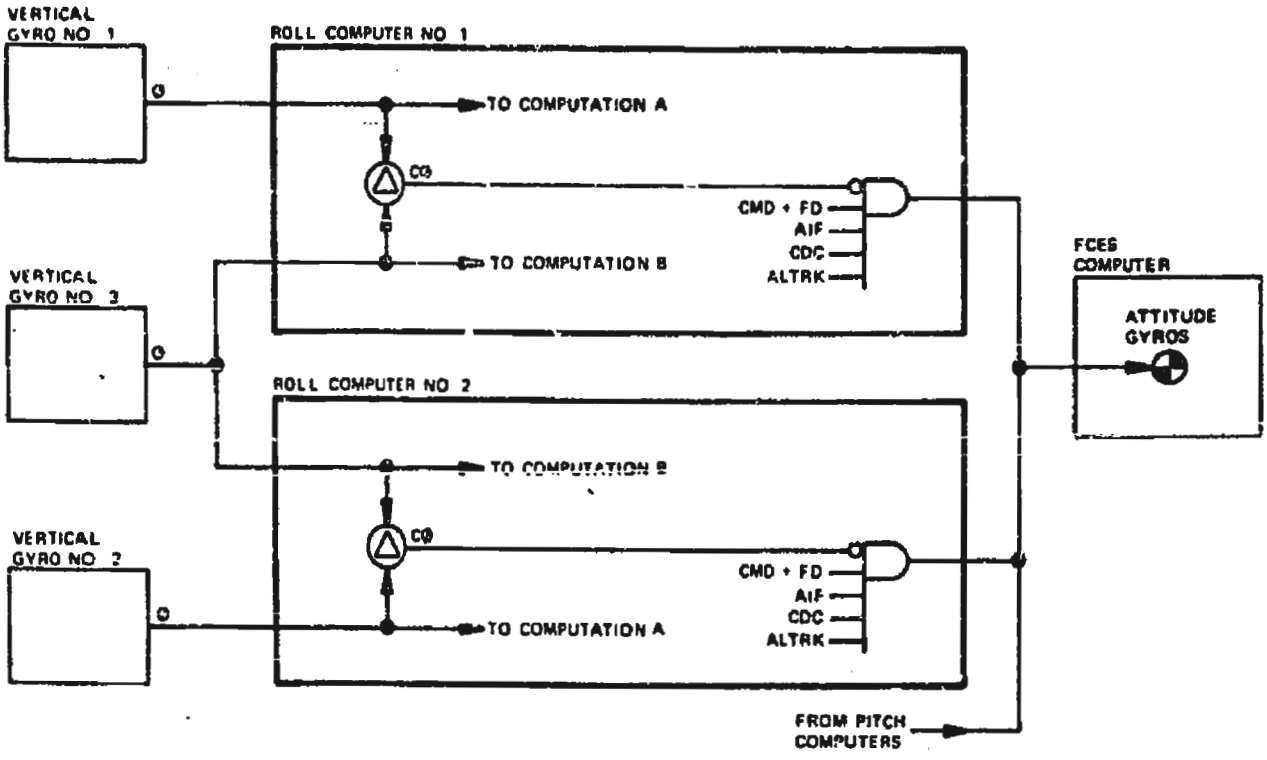
- Caution and Warning Panel (CAWP) Messages - Illumination of the DUAL A/L NOT AVAIL (DANA) message on the CAWP may be caused by an accelerometer fault.

- AFCS WARNING Indicators - During operation in the AUTOLAND track submode with both autopilot channels engaged, the display of a NO DUAL message on both AFCS WARNING indicators may be caused by an accelerometer fault.

(3) ATTITUDE GYROS (Roll) FIM (Ref. Fig. 13)

(a) Fault Detection

Roll altitude reference signals from the three vertical gyros are monitored in the same manner as lateral accelerometer signal outputs. Signals from gyros No. 1 and 2 are routed to the channel A computations circuit in roll computers No. 1 and 2 respectively, while the output from gyro No. 3 is



ABBREVIATIONS:

CO : ROLL ATTITUDE SIGNAL COMPARATOR
CMD • FD : AUTOPILOT ENGAGED IN CMD OR FLIGHT DIRECTOR ENGAGED
AIF : AIRCRAFT IN FLIGHT
CDC : DC POWER MONITOR GOOD
ALTRK : APPROACH/LAND TRACK SUBMODE ENGAGED

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Attitude Gyros (Roll) FIM
Figure 13

EFFECTIVITY: ALL

connected to the channel B computation circuits in both roll computers. A significant difference between the two signals will cause the associated comparator(s) to trip and the ATTITUDE GYROS FIM indicator on the FCES computer will be set if the associated enable logic is present. The ATTITUDE GYROS FIM indicator is the same one which is used to indicate a pitch attitude fault. The FIM fault logic does not indicate which of the three attitude gyros is malfunctioning, since each gyro contains an independent fault detection and indication system.

(b) Enable Logic

The roll ATTITUDE GYROS fault indication circuit is enabled when the flight director is engaged or the autopilot is engaged in CMD, the aircraft is in flight, the dc power monitor indicates good, and the AUTOLAND track submode is engaged. The enable logic is inhibited until AUTOLAND track to reduce nuisance fault indications caused by the normal differences between gyros which occur during roll manuevers. During operation in the AUTOLAND track mode these differences are at a minimum, which permits a lower comparator trip level to be used.

(c) Flight Station Indications

A vertical gyro fault may be the cause of the following flight station indications:

- ADI Displays - Incorrect positioning of the artificial horizon of an ADI may indicate a fault in the associated vertical gyro. Display of the ATT flag may also indicate a fault in the associated gyro, or a difference in signals between the associated gyro and gyro No. 3.

- CAWP Messages - A VERTICAL GYRO 3 message will be illuminated on the CAWP if the roll attitude signal transmitted by gyro No. 3 is significantly different from the signals transmitted by gyro No. 1 and 2. Illumination of the DANA message on this panel may indicate a vertical gyro failure. Display of the message will subsequently result in display of a NO DUAL message on the FACS WARNING indicators if the system is engaged in the fail-operational approach/land configuration.

(4) AREA NAV INPUTS FIM

On aircraft with roll computers modified by Collins SB38, the AREA NAV INPUTS system FIM circuitry is totaly defeated.

A signal comparator is provided in each roll computer to monitor signal inputs from the two area nav systems (if installed). On aircraft with only one system installed, the AREA NAV INPUTS FIM indicator will be set whenever the area nav mode of operation is engaged, and therefore it cannot be used for fault isolation.

R On aircraft equipped with two area nav systems, a
R relatively high rate of nuisance AREA NAV INPUTS fault indications has been observed. It is considered that this is due to the asynchronous output signals of the systems (up to 1.9 seconds) and differences in the sensor signal inputs to the area nav computers.

As a result of this problem, the practical utility of the AREA NAV INPUTS fault indicator has been evaluated, based on the following factors:

- If monitoring circuits in the area nav computer detect a sensor input signal fault, an amber light on the area nav system Control and Display Unit (CDU) will be illuminated.

- If the area nav computer self-test circuits detect a fault, a red light on the CDU will be illuminated, and a NAV flag will be displayed on the associated HSI.

- An area nav system fault will often be detected due to scrambled data or obvious errors in the CDU display, or by incorrect flight director or autopilot operation when the area nav mode is engaged.

- Most of the area computer circuit complexity is contained in the digital computation circuits, with simple digital to analog signal converters provided for APFDS command signal outputs. The computer self-test function monitors the computation circuits, therefore the additional fault isolation capability provided by the roll computer area nav FIM is only in detecting a faulted signal converter.

• Modifications to the area nav computer to include self-test of the digital to analog signal converters are being considered.

In view of the numerous flight station indications which specifically identify an area nav system fault, and the small additional fault isolation capability provided by FIM, it is considered that it is not practical to modify roll computers in an attempt to reduce nuisance fault indications. Therefore, examination of the AREA NAV INPUTS fault indicator and subsequent area nav system trouble-shooting based on this indication is not recommended as a maintenance procedure, particularly if no area nav system fault indications have been observed in the flight station. Also, it is planned to inhibit the area now FIM enable logic in future production of an AREA NAV INPUTS fault indication.

(5) ROLL A/P SERVO 1 and 2 FIM (Ref. Fig. 14)

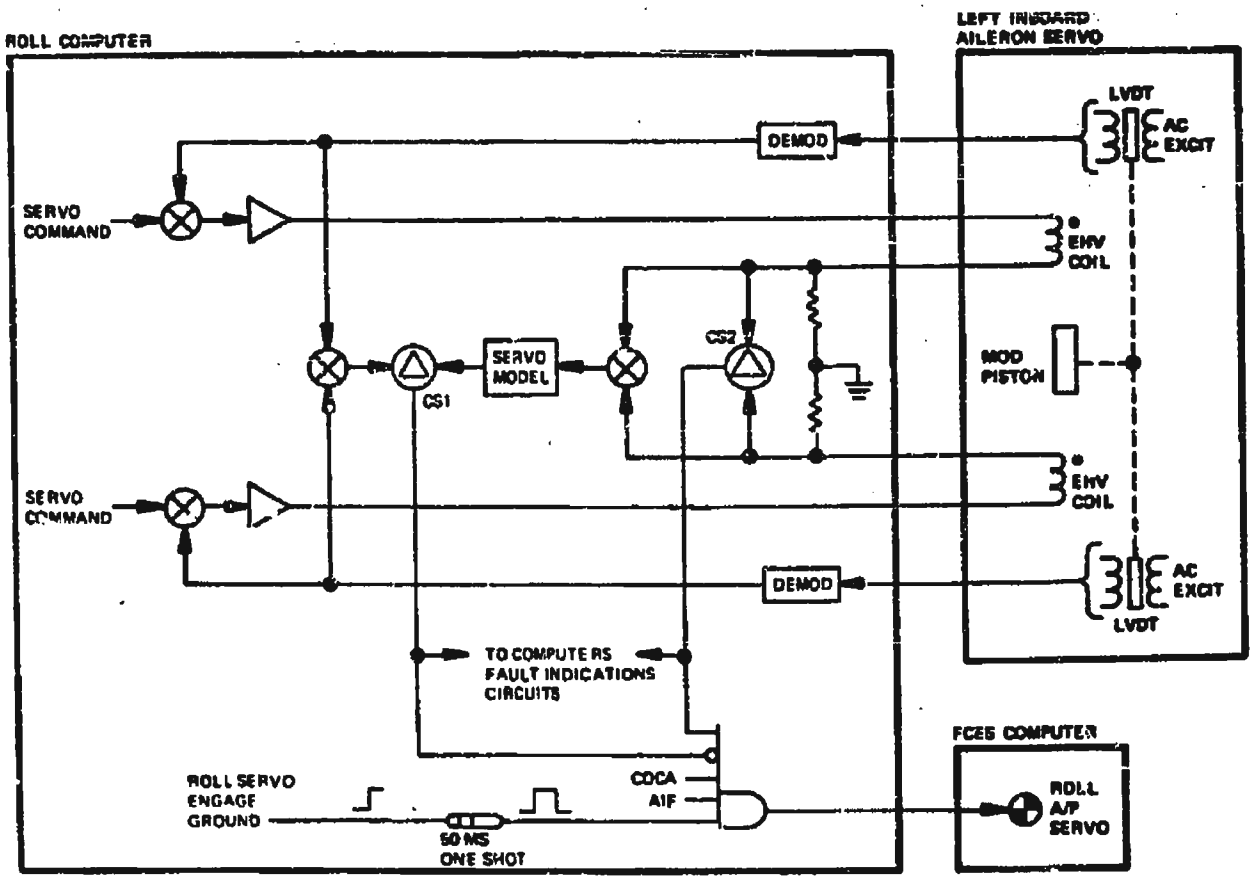
(a) Fault Detection

The FIM servo fault detection logic utilizes the servo comparator which is provided to automatically disconnect the roll autopilot servo if a fault is detected. The comparator monitors the servo LVDT (linear variable differential transformer) feedback signals with respect to a servo model which is excited by the servo command signals. A significant difference between the real and model servos will result in a comparator trip.

(b) Enable Logic

Annunciation of a roll servo fault is enabled if the aircraft is in flight, the computer dc power monitor indicates good, the command comparator is not tripped, and a 50 millisecond pulse resulting from a roll servo disconnect is present.

The command comparator monitors the EHV (electro-hydraulic valve) coil currents. Any significant difference between currents will cause a comparator trip and automatic disengagement of the servo. The trip signal is also used as a part of the FIM logic which detects a computer fault, since a difference in the currents is more probably due to a malfunction in the computer electronic circuits rather than in the EHV coils.



ABBREVIATIONS
CDCA - DC POWER MONITOR A GOOD
AIF - AIRCRAFT IN FLIGHT
CS1 - SERVO COMPARATOR
CS2 - COMMAND COMPARATOR

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R R Roll A/P Servo FIM
Figure 14

R EFFECTIVITY: ALL
R
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The 50 millisecond enable pulse is triggered when the servo is disconnected, either manually or automatically. If a servo comparator trip has caused the disconnect, the command comparator signal will be good, and a roll servo fault will be indicated. If a command comparator trip has caused the disconnect, a similar logic circuit will cause the computer fault indicator to be set (see ROLL COMPUTER FIM description below), while simultaneously inhibiting the servo fault indication logic.

(c) Flight Station Indications

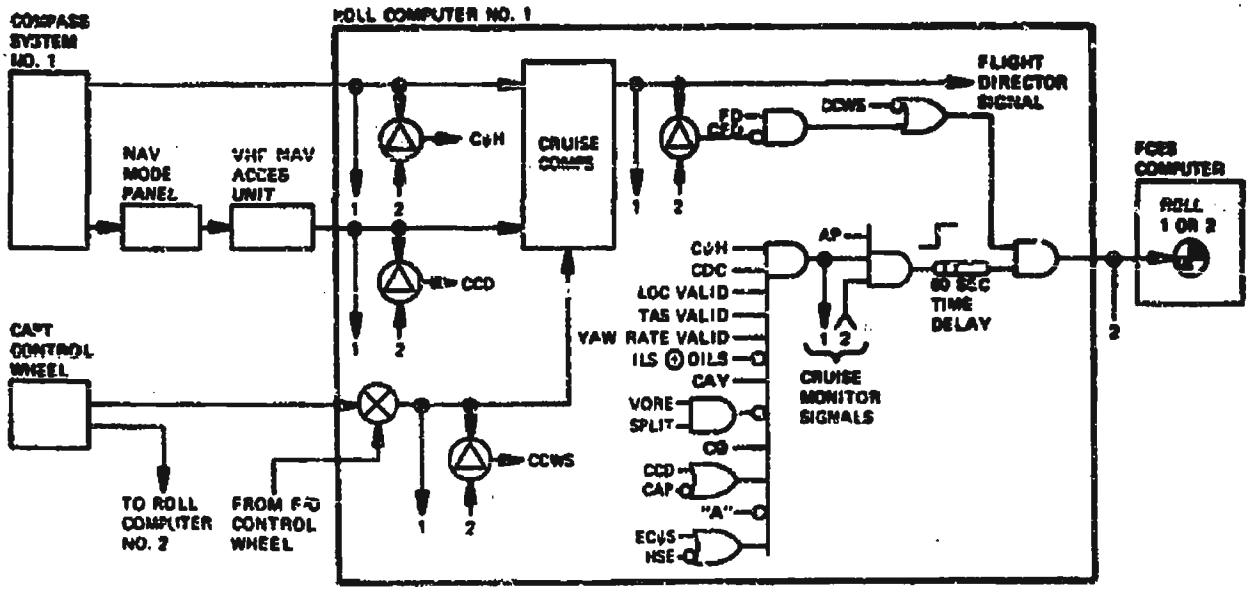
A roll autopilot servo fault may be the cause of an APFDS ENGAGE panel autopilot engage switch drop-off from CMD or CWS to OFF. An AP DISC message will be displayed on both AFCS WARNING indicators if a single autopilot channel was engaged. If both were set to CMD during operation in the AUTOLAND track submode, a NO DUAL message will be displayed on both indicators.

(6) ROLL COMP 1 OR 2 FIM (Ref. Fig. 15)

(a) Fault Detection

A ROLL COMP 1 or 2 fault indication will be displayed on the FCES computer when a roll computer fault is detected but cannot be isolated to either computer. This condition may occur during cruise modes of operation (all modes except AUTOLAND track, go-around, and takeoff), since cruise computations in each computer are single-channel. As indicated in the figure, a difference between cruise computations will cause the flight director comparator (CFD) to trip. If a sensor fault has not been detected and if operating conditions which might cause a difference between computations are not present, a fault exists in roll computer 1 or 2, and this fault indication is displayed.

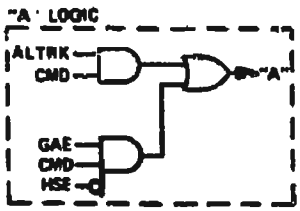
A control wheel steering comparator (CCWS) trip will also cause a ROLL COMP 1 OR 2 fault indication under the same conditions. Although a difference between control wheel steering signals could be due to a malfunctioning control wheel force transducer, the fault will more probably be in the signal processing circuits of a computer, and therefore a computer fault is indicated.



ABBREVIATIONS:

1 = SIGNAL TRANSMITTED TO COMPUTER NO 2
2 = EQUIVALENT SIGNAL FROM COMPUTER NO 2
C&H = HEADING HOLD COMPARATOR
CCD = COURSE DATUM COMPARATOR
CCWS = CONTROL WHEEL STEERING COMPARATOR
CFD = FLIGHT DIRECTOR COMPARATOR
CDC = DC POWER MONITOR
CAY = LATERAL ACCELEROMETER COMPARATOR
CB = ROLL ATTITUDE COMPARATOR
ECWS = ENABLE HEADING SELECT COMPARATOR
FD = FLIGHT DIRECTOR ENGAGED
AP = AUTOPILOT ENGAGED

LOC VALID = LOCALIZER SIGNAL VALID
TAS VALID = TRUE AIRSPEED SIGNAL VALID
ILS = ILS FREQUENCY TUNED THIS SIDE
OILS = OTHER SIDE ILS FREQUENCY TUNED
⊙ = EXCLUSIVE OR = ILS OR ILS BUT NOT BOTH
VORE = VOR MODE ENGAGED
SPLIT = SPLIT OPERATION OF VOR MODE
CAP = VOR OR LOCALIZER BEAM CAPTURED
HSE = HEADING SELECT MODE ENGAGED
ALTRK = AUTOLAND TRACK SUBMODE ENGAGED
CMD = EITHER OR BOTH AUTOPILOTS ENGAGED IN CMD
GAE = GO AROUND MODE ENGAGED



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R Roll Computer 1 or 2 FIM
R Figure 15

R EFFECTIVITY: ALL

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Page 37
May 15/76

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(b) Enable Logic

The unable logic for the ROLL COMP 1 OR 2 fault annunciation circuit is derived from an autopilot engage signal and cruise monitor signals from both computers. The logic is delayed for 60 seconds after becoming good, to ensure that integrators and other time-dependent functions in the computers have stabilized and will not cause a CFD trip.

The cruise monitor signal will become false and will inhibit the enable logic if a sensor fault is detected or if operating conditions are such that a difference between computed flight director command signals can be reasonably expected as a result of normal aircraft operations. The cruise monitor signals are cross-fed between computers to ensure that a ROLL COMP 1 or 2 fault indication will not be displayed as a result of a single sensor fault causing unbalanced computations.

Input signals to the cruise monitor gate which will inhibit the enable logic, and associated FIM fault indicators which will be displayed, are as follows:

- Heading Hold Comparator Trip - This comparator detects any significant difference between compass system heading hold signal inputs. Since a difference between signals is indicative of a compass system fault, the enable logic is inhibited when this comparator is tripped. A true compass system fault will be detected by the heading select comparator.

- DC Power Monitor Trip - A trip of this monitor will cause the roll computer FIM fault indicator to be displayed.

- Loss of LOC Valid - When a VOR frequency is selected on either of the VHF NAV glareshield panels, the ILS receiver associated with the panel is switched into a self-test (cruise monitor) mode, and a localizer (instrument) valid signal is continuously transmitted to the associated roll computer. If the receiver self-test circuits detect a fault, the validity signal is interrupted and a latching fault indicator is set on the front of the unit.

When an ILS (localizer) frequency is selected, the receiver is switched to its normal operating mode. Under these conditions the receiver fault indicator will not be set if the localizer valid signal is lost, since low localizer RF signal strength may be the cause. Loss of the localizer valid signal, whether due to a receiver fault or low signal strength, will be indicated by a flag on the HSI associated with the receiver.

- Loss of TAS Valid - Each pitch computer receives a true airspeed (TAS) valid signal from its associated air data computer (ADC). This signal is combined with a pitch computer dc power monitor signal and transmitted as a processed TAS valid signal to the associated roll computer. If the ADC monitoring circuits detect a TAS fault, the validity signal will be interrupted and a latching fault indicator will be set on the ADC. A pitch computer power failure, which would also interrupt the processed TAS valid signal, will be annunciated by the computer FIM indicator.

- Loss of Yaw Rate Valid - Each yaw computer transmits a processed yaw rate valid signal to its associated roll computer. A rate gyro fault will be detected by the yaw computer and will cause a YAW RATE GYRO fault indication to be displayed on the FCES computer. A power fault in the yaw computer, which would interrupt the yaw rate valid signal, will cause a yaw computer FIM fault indicator to be displayed.

- ILS or Other ILS Logic - Signals indicating whether a VOR or ILS (localizer) frequency has been selected on each VHF NAV panel are routed through an exclusive OR gate and are notted at the input to the cruise monitor gate. This logic will inhibit the enable logic if an ILS frequency is selected on one panel and a VOR frequency on the other. This is to guard against a CFD trip during operation in the localizer, approach, and approach/land (prior to AUTOLAND track) modes, since only one cruise computation will receive localizer deviation signals. With a VOR or ILS frequency selected on both panels, the enable logic is not inhibited.

• Lateral Accelerometer Comparator Trip - As previously described, a lateral accelerometer comparator trip will cause a LATERAL ACCEL fault indication to be displayed on the FCES computer.

• VOR Mode Engaged/Split Operation Logic - During operation in the VOR mode, it is standard practice to control the aircraft to one VOR radial while pre-selecting another. Since this will cause differences in the cruise computations, the enable logic is inhibited when the VOR mode is engaged and the VOR switch on the NAV MODE glareshield panel is set to the SPLIT position. When the switch is set to the 1 or 2 position, one VOR receiver output signal is used by both computers and CFD will be tripped only in the event of a computer fault.

• Roll Attitude Comparator Trip - As previously described, a roll attitude comparator trip will cause an ATTITUDE GYROS fault indication to be displayed on the FCES computer.

• Course Datum Comparator/Capture Logic - This logic inhibits the enable logic when the course datum comparator is tripped and a VOR or localizer beam has been captured. As in the case of a heading hold comparator trip, a difference between course datum signals is indicative of a compass system fault which will be detected by the heading select comparator. If a heading system fault is not detected during maintenance tests, a NAV MODE panel or VHF Nav Accessory Unit fault is indicated.

• A Logic - The A logic inhibits the enable logic when the autopilot is engaged in command and the AUTOLAND track submode has been established or the go-around mode has been selected and the heading select mode is not engaged. During operation under these conditions (and others), a fault can be detected and isolated to an individual computer, as described in the Roll Computer Fault FIM section.

• Heading Select Comparator/Heading Select Engaged Logic - This logic inhibits the enable

logic when the enable heading select comparator is tripped and the heading select mode is engaged. The FIM heading select comparator is set to trip when the difference between compass system signal inputs exceeds 6 degrees, and will cause a HDG INPUTS fault indication to be displayed on the FCES computer. A difference of 6 degrees (or less) could also cause a CFD trip due to the signal gain characteristics of the cruise computations. Therefore, the enable heading select comparator is set to trip at 2 degrees, to ensure that the ROLL COMP 1 OR 2 fault indicator will not be set prior to HDG INPUTS fault indicator.

(c) Flight Station Indications

A fault in roll computer No. 1 or 2 may be the cause of the following flight station indications:

- ADI Displays - Differences between the Captains and First Officers flight director roll commands may be caused by a fault in one of the two roll computers.

- APFDS ENGAGE Panel Switches - An autopilot disconnect when roll force is applied to a control wheel may be caused by a roll computer fault. An AP DISC message will be displayed on both AFCS WARNING indicators.

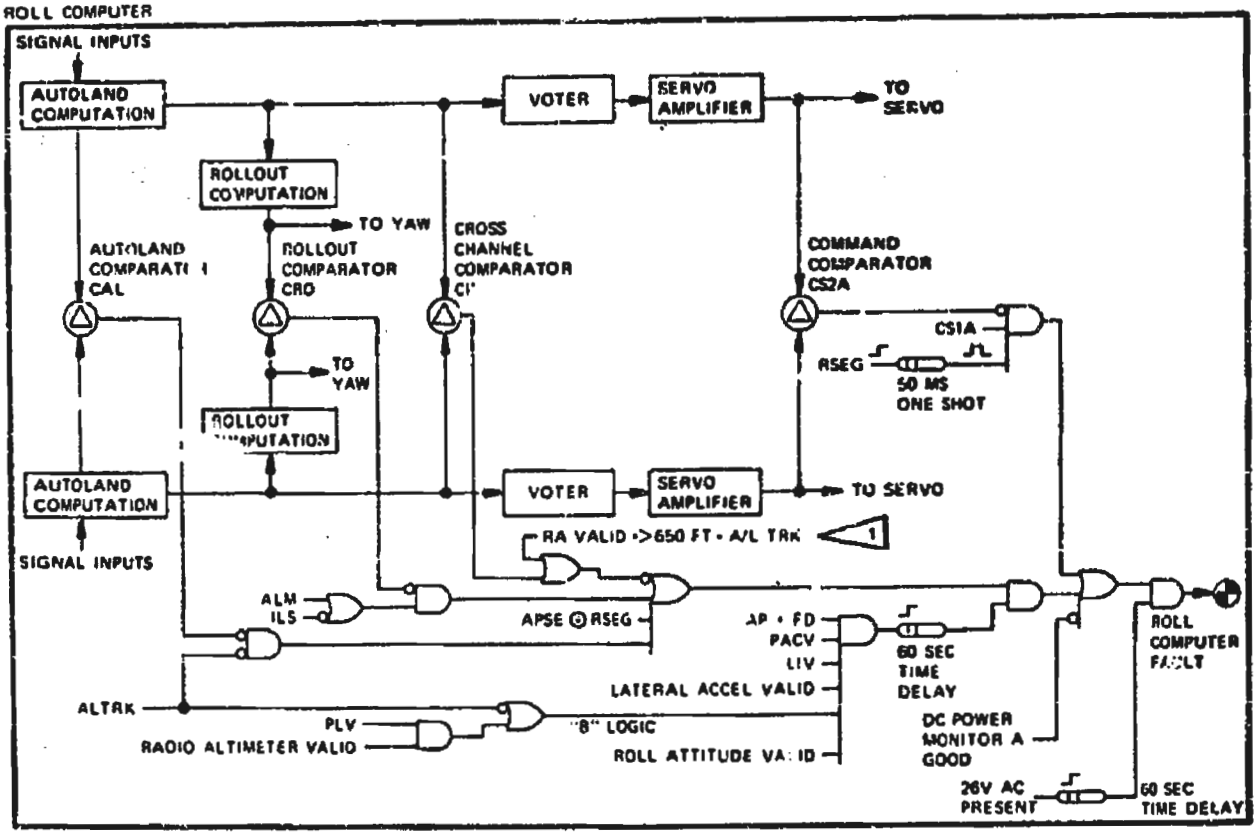
- Control Wheel Forces - Lack of response to normal control wheel forces with CWS engaged may be caused by a roll computer fault.

(7) Roll COMPUTER FAULT FIM (Ref. Fig. 16)

R (a) Fault Detection

R A roll computer fault indication will be displayed
R if a computer fault is detected and can be
R isolated to one of the two computers. As
R indicated in Figure 16, fault detection is provided primarily by four signal comparators which detect any significant difference between the dual computation channels of a computer. Additional fault detection is provided by a dc power monitor, and logic circuits which detect any malfunction in the roll servo engagement circuits.

(b) Enable Logic



ABBREVIATION:

ALM	= ALIGN MODE ENGAGED
ILS	= ILS FREQUENCY SELECTED
ALTRK	= AUTOLAND TRACK MODE ENGAGED
PLV	= PROCESSED LOCALIZER VALID
AP • FD	= THIS SIDE OR OTHER SIDE AUTOPILOT OR FLIGHT DIRECTOR ENGAGED
PACV	= PROCESSED ALIGN COMMAND VALID (FROM YAW COMPUTER)
APSE	= AUTOPILOT SERVO ENGAGE LOGIC GOOD
RSEG	= ROLL SERVO ENGAGE GROUND LOGIC GOOD
⊙	= EXCLUSIVE OR • APSE OR RSEG BUT NOT BOTH
CS1A	= SERVO COMPARATOR CS1A GOOD
LIV	= LOCALIZER INSTRUMENT VALID
SIGNAL INPUTS	= YAW, LOCALIZER, LATERAL ACCEL, ROLL ATTITUDE, AND RADIO ALTITUDE SIGNALS
RA VALID • 650 FT • A/L TRK	= START OF AUTOLAND TRACK TO THE POINT AT WHICH THE AIRCRAFT PASSES THROUGH 650 FEET OF ALTITUDE

EFFECTIVITY

1 WITH COLLINS SB 38

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Roll Computer Fault FIM
Figure 16

EFFECTIVITY: ALL

A computer fault indication is inhibited for 60 seconds after power is applied (26V ac present) to insure that system transients will not cause a comparator trip. After this period, the following fault detection and enable logic combinations will result in a computer fault indication display:

- DC Power Monitor Trip - As indicated in the Figure 16, a DC power monitor trip at any time after the 60 second delay will set the fault indicator.

- Command Comparator Trip - A command comparator trip will set the fault indicator if the servo comparator is not tripped and a 50 millisecond pulse resulting from a roll servo disconnect is present. The fault indication will be inhibited if a servo comparator trip has caused the disconnect, and a roll servo FIM indicator will be set, as described in the section on ROLL AUTOPILOT SERVO 1 and 2 FIM.

- Cross-Channel Comparator Trip - A cross-channel comparator trip will set the computer fault indicator if the autopilot or flight director is engaged, the processed align command, lateral accelerometer, roll attitude and localizer instrument valids are good, and the "B" logic is true.

R On aircraft with roll computers modified by
R Collins SB38, the cross-channel comparator
R (C1') trip to the roll computer FIM is
R inhibited from the start of AUTOLAND track to
R the point at which the aircraft passes through
R 650 feet of altitude.

The validity signals are used to determine that a signal unbalance between the AUTOLAND computations has been caused by a roll computer fault, rather than by a difference between the input signals from an external source. For example, if the fault detection circuits in a yaw computer detect a difference in the signals transmitted to its associated roll computer, the processed align command valid signal is interrupted, which inhibits the enable logic for the roll computer fault indicator. The other validity signals and the "B" logic signal are used for the same purpose.

The "B" logic signal adds the (processed) AFCS localizer and radio altimeter valid signals to the enable logic when the AUTOLAND track submode is engaged. During operation in this mode the computation circuits are in a high gain configuration and an ILS receiver fault must be detected quickly to avoid a nuisance roll computer fault indication. Therefore, the AFCS localizer valid signal is used as a part of the enable logic in addition to the localizer instrument valid signal, since it is interrupted much more quickly in the event of a receiver fault. The radio altitude input signals are used only during operation in the AUTOLAND track submode; therefore the radio altitude valid signal is added to the enable logic at this time.

The output signal of the enable logic circuit is delayed for 60 seconds after becoming true to insure that the AUTOLAND computations have stabilized and the dual output signals are balanced.

- Rollout Comparator Trip - A computer fault will be indicated if the rollout comparator is tripped, an ILS frequency is not tuned or the align submode is engaged, and the enable logic described above for the cross-channel comparator is true.

The ILS frequency tuned and align mode logic inhibits the enable logic during localizer capture manuevers to reduce nuisance fault indications caused by amplifier saturation.

- Autoland Comparator Trip - Prior to AUTOLAND track a computer fault will be indicated if the AUTOLAND comparator is tripped and the enable logic described above for the cross-channel comparator is present. When the AUTOLAND track submode is engaged, the cross-channel comparator is used to detect any significant difference between signals.

- Autopilot Servo Engage/Roll Servo Engage Logic - This logic will detect a fault in the roll servo engage logic circuits. If the inputs to the exclusive OR gate disagree, a fault signal will be generated and will cause a fault indication if the enable logic

described above for the cross-channel comparator is true.

(c) Flight Station Indications

A roll computer fault may be the cause of the following flight station indications:

- APFDS ENGAGE Panel Switches - An autopilot engage switch drop-off from CMD or CWS to OFF may be caused by a command comparator trip or loss of dc power. An AP DISC message will be displayed on both AFCS WARNING indicators if a single autopilot channel was engaged. If both were set to CMD during operation in the AUTOLAND track submode, a NO DUAL message will be displayed on both indicators.

- ADI Displays - Removal of the flight director command cue(s) from view and display of a FD flag may be caused by loss of dc power.

- AFCS WARNING Indicator Message - Display of NO DUAL messages on both AFCS WARNING indicators during operation in the AUTOLAND track submode may be caused by a significant difference in the command signals generated by the two AUTOLAND computation circuits of a computer.

- CAWP Messages - Illumination of a DANA message on the CAWP may be caused by a significant difference between AUTOLAND computations, or loss of dc power.

R 3. Yaw Stability Augmentation System FIM

R A. General

R The yaw stability augmentation system (SAS) FIM monitors the yaw computers, yaw SAS servos, and yaw rate gyros. Table 2 lists the names of the yaw SAS FIM indicators, their locations and the computers controlling them.

R Yaw SAS FIM Indicators
Table 2

NAME	LOCATION	CONTROLLING COMPUTER
YAW RATE GYRO 1	FCES Computer	Yaw Computer No. 1
YAW RATE GYRO 2	FCES Computer	Yaw Computer No. 2
YAW RATE GYRO 3	FCES Computer	Yaw Computer No. 1 or 2
YAW SAS SERVO 1	FCES Computer	Yaw Computer No. 1
YAW SAS SERVO 2	FCES Computer	Yaw Computer No. 2
CMPTR FAULT	Yaw Computer No. 1 or 2	Yaw Computer No. 1 or 2

R The basic conditions for yaw SAS FIM annunciation to occur are as follows:

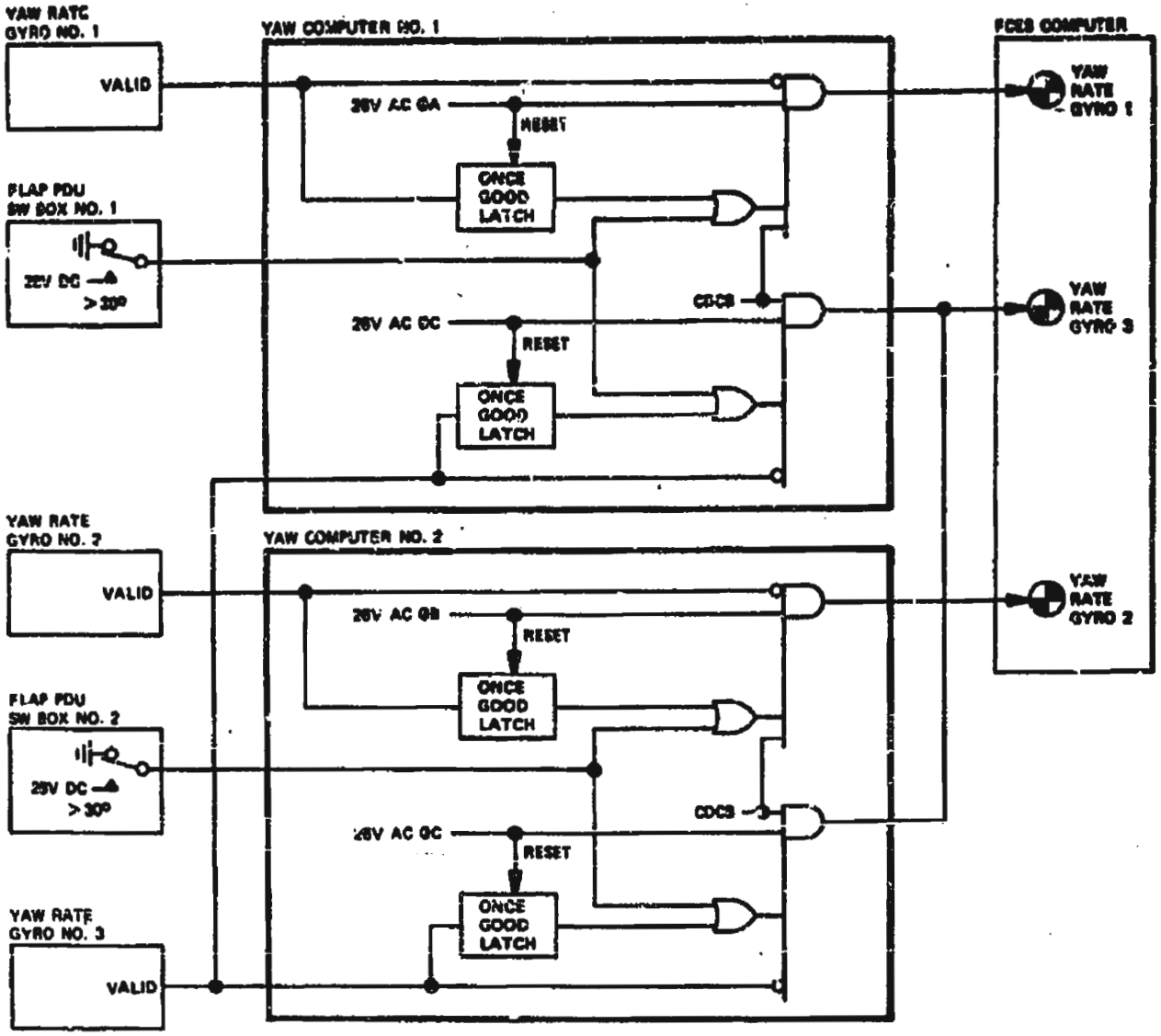
- The enable function is satisfied. The enable function is used to permit a FIM annunciation only under the proper conditions.
- The FIM monitors have detected a fault condition.

The above two conditions simply state that the enable (or arming) function must be valid before a specific FIM annunciation is allowed to occur. This is to ensure that the correct fault is indicated.

R B. YAW RATE GYRO FIM (Ref. Fig. 17)

R (1) Fault Detection

The yaw rate gyros have built-in spin monitors. This circuitry provides a valid output if the gyro motor is within 25 percent of its nominal speed. If the motor speed falls outside of the accepted range, the gyro spin monitor will provide a logic fail output. With the yaw rate gyro FIM circuits enabled, a fail output



ABBREVIATIONS:
CDCB = POWER SUPPLY VALID
> = GREATER THAN

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Yaw Rate Gyro FIM
Figure 17

EFFECTIVITY: ALL

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R will result in the display of the YAW RATE GYRO fault
R indication on the FCES computer.

R (2) Enable Logic

R Certain functions must be operable to enable or arm the
R yaw rate gyro FIM drive circuitry. These enable
R functions are:

R • CDCB - The yaw computer DC power supply monitor
R B (CDCB) must be valid.

R • The yaw computer AC power monitor for the
R affected yaw rate gyro must be valid.

R • The "once good latch" function must be valid.

R (a) Once Good Latch Enable Function

R The problem of inhibiting or controlling the YAW
R RATE GYRO fault indicators during the gyro speed
R run-up is handled by the Once Good Latch enable
R function.

R When power is first applied, the yaw rate gyro is
R providing a fail input to the once good latch which
R inhibits the RATE GYRO fault indicators from being set.
R If the yaw rate gyro does not achieve a valid output,
R this state still applies. Thus the FIM annunciation is
R inhibited until the flaps are lowered to greater than
R 30 degrees. This logic input will then allow a RATE
R GYRO fault indication.

R If, after power is applied, the yaw rate gyro does
R achieve a valid output, the circuit then operates to
R allow annunciation of a YAW RATE GYRO fault indication
R regardless of flap position.

R The "Once Good Latch" function is to prevent nusiance
R YAW RATE GYRO fault indicator annunciations due to
R maintenance activities, etc. A good guideline is:

R • Once the yaw rate gyro achieves a valid
R condition, fail annunciation is worth annunciating
R now.

R • A yaw rate gyro that does not achieve a valid
R output is not worthy of annunciation until flaps
R are lowered past 30 degrees.

R (3) Flight Station Indications

R Yaw rate gyro failures can cause three flight station
R indications:

R • YAW SAS FAIL lights on the overhead panel with
R an associated CAWP annunciation.

R • DANA annunciation on the CAWP panel.

R • NO DUAL annunciation on the AFCS WARNING
R indicator.

R (a) YAW SAS FAIL Annunciations

R Two yaw rate gyro failures have to exist before a
R YAW SAS failure will occur. In this case, both
R YAW SAS FAIL 1 and 2 legends come on.

R (b) DUAL A/L NOT AVAIL Annunciation

R When the DUAL A/L NOT AVAIL (DANA) enable
R functions are valid, a single yaw rate gyro
R failure will always result in a DANA light prior
R to AUTOLAND track.

R After AUTOLAND track, DANA annunciations due to a
R yaw rate gyro failure will only occur on a recall
R basis after the airspeed has dropped below 90
R knots.

R (c) NO DUAL Annunciation

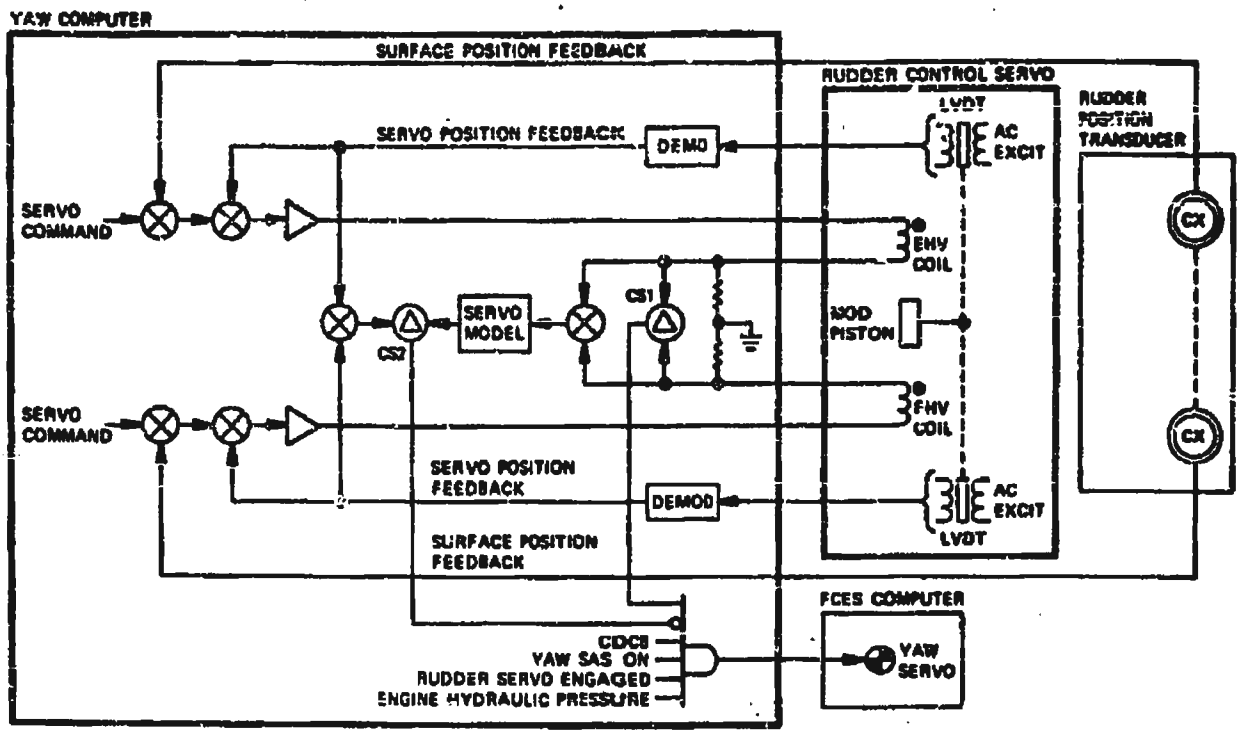
R When the NO DUAL enable functions are valid, a
R single yaw rate gyro failure can cause a NO DUAL
R annunciation on the AFCS WARNING indicator.

R • NO DUAL annunciations as a result of yaw
R rate gyro failures can only occur after
R AUTOLAND track.

R • If the aircraft is below 150 feet when a yaw
R rate gyro failure occurs, the NO DUAL
R annunciation will be inhibited.

R C. YAW SAS SERVO FIM (Ref. Fig. 18)

R Fail annunciation of a yaw SAS servo fault requires certain
R enable functions to exist similar to those required for
R pitch and roll systems. In that the yaw SAS system can be
R latched on or OFF with switches on the overhead FCES control
R panel, enable functions will differ somewhat from those
R required for pitch and roll systems.



ABBREVIATIONS:
CDCB = DC POWER MONITOR & GOOD
CS2 = SERVO COMPARATOR
CS1 = COMMAND COMPARATOR

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Yaw SAS Servo FIM
Figure 18

EFFECTIVITY: ALL

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R Servo fault detection is accomplished in a similar manner to
R pitch and roll servo monitoring.

R (1) Fault Detection

R Key monitoring points for the YAW SAS SERVO fault
R indicator are:

R • comparison of the dc currents flowing through
R the Electro-Hydraulic Valves (EHV) coils by
R comparitor CS1 (Ref. Fig. 18).

R • comparison of the Servo Mod piston position
R relative to the commanded position by comparitor
R CS2.

R These two comparators are continuously active in
R assessing servo status. Tripping CS1 will most likely
R occur as a result of errors in the computational inputs
R from the yaw computer. CS1 thus is used as an inhibit
R function to prevent YAW SAS SERVO fault indicator
R annunciation. The only fault detector which will
R result in annunciation of a YAW SAS SERVO fault
R indicator is the CS2 Comparator. CS2 compares Servo
R Mod Piston response relative to that being commanded.
R These comparators serve reverse functions for the yaw
R computer FIM system.

R (2) Enable Functions

R The yaw servo comparator CS2 will not cause a YAW SAS
R SERVO fault indicator annunciation unless the following
R enable functions are correct:

R • Coil current comparator CS1 - The most probable
R cause for CS1 trips is considered to be faulty
R computations from the yaw computer. Therefore CS1
R is an enable function for the YAW SAS SERVO fault
R indicator. CS1 serves as a fault signal for the
R yaw computer FIM.

R • Power Supply Monitor B - COCB - The yaw computer
R dc power supply must be good to enable the YAW SAS
R SERVO fault indicator.

R • Yaw SAS ON - The yaw SAS must be engaged to
R enable the YAW SAS SERVO fault indicator. This
R logic signal comes from the overhead FCES control
R panel.

R • Hydraulic Pressure - Hydraulic Pressure must be
R present to enable the YAW SAS SERVO fault

indicator. This signal comes from pressure switches located at the engine hydraulic pressure line. This logic is required to prevent loss of hydraulic pressure from setting a YAW SAS SERVO fault indicator with the Yaw SAS system on.

• Rudder Servo Engaged - Application of hydraulic pressure to the Rudder Servo Mod Piston is controlled from the overhead FCES control panel and other enable functions in the yaw computer. It is possible to have the yaw SAS system on but have a yaw computer fault exist which will prevent mod piston engagement. Thus this function is used as an enable control for the YAW SAS SERVO fault indicator.

(3) Flight Station Indications

A yaw SAS servo failure results in a fail annunciation on the overhead FCES control panel. NO DUAL is annunciated when in AUTOLAND track if both A/P Bat handles are not engaged.

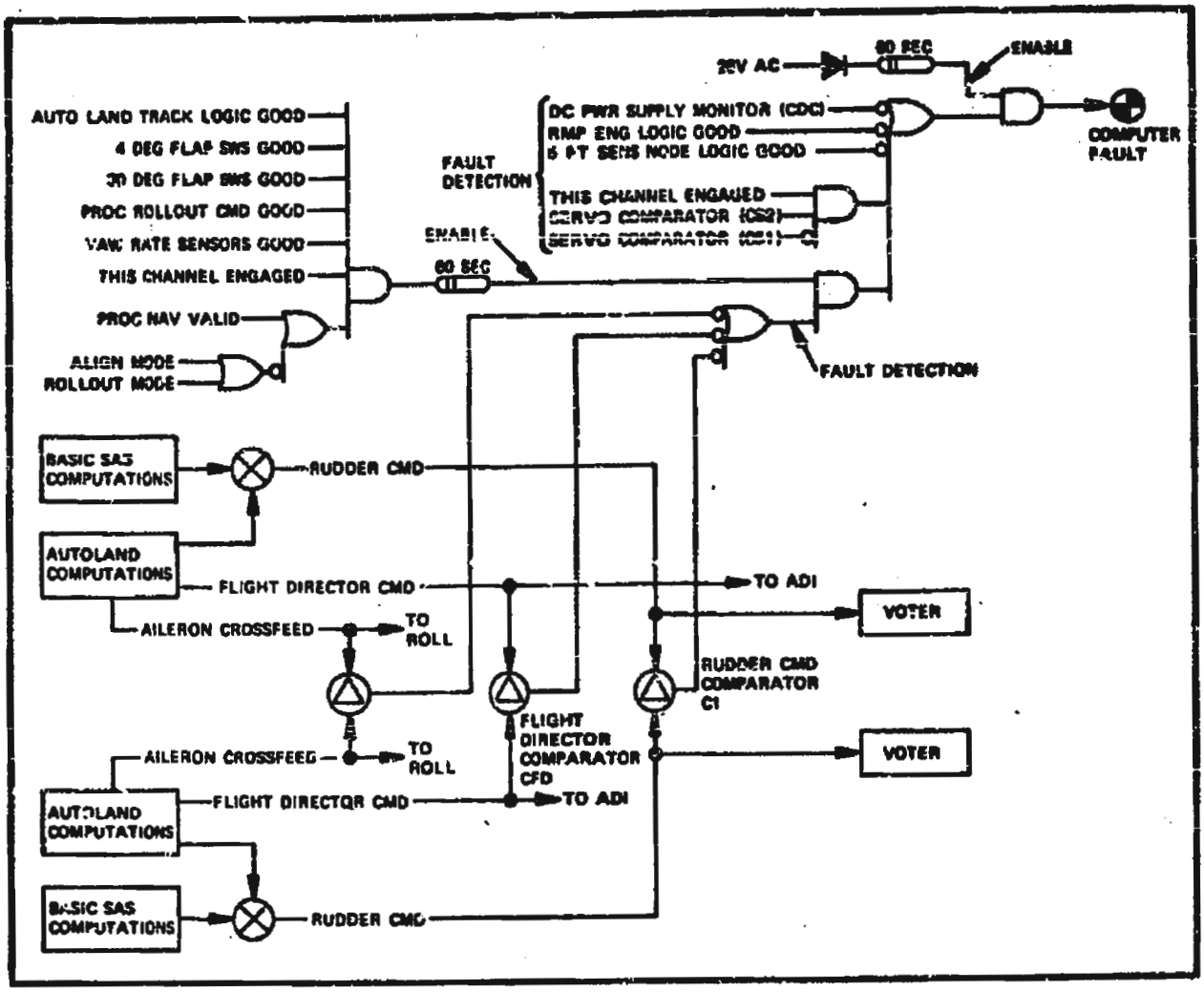
D. YAW SAS COMPUTER FIM (Ref. Fig. 19)

(1) Fault Detection

As indicated in Figure 19, there are numerous fault conditions that, upon occurance, will result in a yaw computer fault being annunciated. Anyone of these fault conditions, described below, is sufficient to annunciate a computer fault.

• DC Power Supply Monitor (CDC) - the regulated dc supplies (±28V dc, ±12V dc, +5V dc) used for logic and analog signal processing are monitored for proper voltage levels. An abnormal regulated supply voltage is indicative of a computer failure.

• Rudder Modulating Piston (RMP) Engage Logic Good - the rudder modulating piston engage logic signals generated in each of the two channels (A and B) are compared. These signals are redundant in function and identical in composition and would normally agree, irrespective of the system engagement status (i.e., engaged and/or disengaged). These signals are compared for agreement between the two. A disagreement is recognized as a computer fault.



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Yaw SAS Computer Fault FIM
Figure 19

EFFECTIVITY: ALL

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R • 5 Foot Sensor Node Logic Good - these logic signals generated in each of the two channels (A and B) are derived from radio altitude information and are used to sense when the aircraft is below 5 feet and are used in conjunction with other Rollout Mode logic requirements to initialize the Rollout Mode. These signals are redundant in function and identical in composition and would normally agree irrespective of the system engagement status. The signals are compared for agreement between the two, and a disagreement is attributed as a computer fault.

R • Servo Comparators CS1 and CS2 monitor the Electro-Hydraulic Transfer Valve (EHV) coil currents and modulating piston positions respectively (refer to yaw servo FIM discussion). These comparators are used for isolating a failure either to the yaw computer or to the rudder servo. CS2 effectively monitors that the servo responded to the computed commands, and CS1 monitors that the servo received the computed commands. These comparators are ignored unless this channel of yaw SAS is engaged. With the channel engaged and CS2 comparator indicating the modulating pistons are functioning properly, a tripping of CS1 indicates a failure in the computed servo command, and a fault is attributed to the computer.

R • Autoland Comparator (CA/L) - compares the channel A and Channel B AUTOLAND computations resultant aileron command crossfeeds. These crossfeed signals are transmitted to the roll computer and are used to perform a forward slip maneuver in conjunction with runway alignment control performed through the rudder axis at initialization of the Alignment Modes when performing on AUTOLAND. A difference between the two crossfeed signals which exceeds the threshold of the comparator is attributed to a faulted computer.

R • Flight Director Comparator (CFD) - compares the channel A and channel B flight director commands that are displayed on the Attitude Director Indicator (ADI) yaw steering pointer during the final stages of an automatic landing. A failure is attributed to the computer when the difference between the steering commands exceeds the threshold of the comparator.

- Rudder Command Comparator (C1) - compares the channel A and channel B rudder commands that are generated for control of the rudder. These commands are compared upstream of the voters and thus are considered as the raw rudder commands as opposed to the servo commands which are compared by CS1. A difference between the raw rudder commands which exceeds the threshold of C1 is attributed as a computer fault.

(2) Enable Logic

As indicated in Figure 19, there are enable logics that must be staisfied to enable a computer fault to be annunicated. These enable functions are:

- 26V ac must be present for 60 seconds - this 26V ac is an indication that aircraft electrical power is applied to the computer and is derived from the 26V ac secondary winding of the computer power transformer. The 60 second time delay allows adequate time for power stabilization and yaw rate gyros to spin-up.

All of the following enable functions must be satisfied for 60 seconds before a computational comparator can indicate a computer fault:

- Autoland Track Logic Good - the channel A and channel B Autoland Track logic signals received from the roll computer are compared. If the two signals should disagree, the computations in channels A and B of the yaw computer would disagree and result in the computational comparators being tripped. To prevent the computer fault ball from being falsely tripped, a computational comparator is inhibited from triggering the fault ball when the two Autoland Track logic signals disagree.

- 4 Degree Flap Switches - the channel A and channel B 4 degree flap switch logic signals received from the Flap Power Drive Unit are used to control the respective channel command signal characteristics. If the flap switches should differ, the channel A and B command signal characteristics would differ. Thus, a computer fault ball being triggered by a computational comparator is inhibited when the 4 degree flap switches disagree.

R • 30 Degree Flap Switches - these switches are used in the same manner as the 4 degree flap switches. Thus, when these switches disagree a computational comparator trip is prevented from annunciating a computer fault.

R • Processed Navigation Valid - this logic signal received from the roll computer must be good during the Alignment and Rollout modes to enable a computational comparator to set a computer fault annunciation during these modes. This is used to prevent the yaw computer from being falsely identified as a faulty computer when the associated in-line monitored localizer receiver has faulted.

R • Processed Rollout Command Good - The Processed Rollout command logic signal received from the roll computer is used to inhibit a yaw computer fault from being annunciated as the result of a computational comparator trip. The Rollout Command logic signal indicates if the processed rollout command signals generated in the two channels of the roll computer, and used by the yaw computer during alignment and rollout, are tracking within the threshold of the rollout command comparator (CRO). If the two rollout commands transmitted to yaw are not tracking, then a yaw computational comparator is prevented from triggering a yaw computer fault.

R • This Channel Engaged - Unless this channel is engaged in performing active control, the computational comparators are inhibited from tripping the computer fault ball.

R (3) Flight Station Indications

R The following flight station indications can occur as a result of a faulted yaw computer:

R • YAW SAS FAIL light on the overhead FCES control panel with an attendant FLT CONTROL PANELS annunciation on the caution and warning panel.

R • DUAL A/L NOT AVAIL annunciation on the caution and warning panel.

R • NO DUAL warning message on the AFCS WARNING indicators.

R • NO ALIGN warning message on the AFCS WARNING
R indicators.

R • AP DISC warning message on the AFCS WARNING
R indicators.

R This is not to say, that the yaw computer is the only
R component that, when faulted, will cause any of the
R above annunciations.

R 4. Flight Control Electronics System (FCES) FIM

R A. General

R Besides being the housing for all FIM indications except the
R computer (pitch, roll, yaw, speed control, and trim
R augmentation) fault indications; the flight control
R electronics system (FCES) computer provides FIM for the
R following subsystems: Direct Lift Control (DLC), Primary
R Flight Control System (PFCS) Monitoring, and Stall Warning.
R Table 3 lists the name of the fault indicator and the
R subsystem to which it is associated.

R The basic condition for the FCES computer FIM systems to be
R active is that 115V ac power be applied to both channels of
R the FCES computer. There are three basic areas monitored by
R the FCES FIM. They are:

R • Sensor signals that provide input to the FCES
R computer.

R • Redundant single channel computations of DLC, PFCS
R Monitoring and Stall Warning in the FCES computer.

R • Direct Lift Control Servo

R In the case of the sensors, (Ref. Table 3) the FCES computer
R can set both ANGLE OF ATTACK (AOA) Sensor and DLC SWITCHES
R fault indicators. A failure in the computational channels
R of DLC, PFCS Monitoring, Stall Warning, or a Power Supply
R failure will be indicated by a computer fault indicator. A
R fault in the DLC Servo will be indicated by DLC SERVO 1 or
R DLC SERVO 2 fault indicator.

R It can be seen that the PFCS monitor does not have fault
R indicators for its sensors. This is done because failures
R of the PFCS Monitor Sensors (switches) is exhibited in the
R flight station and failures of these switches is indicated
R if the FCES computer is not faulted (no computer fault
R indicator). The stick shaker is part of the Stall Warning
R System and is analogous to the servo portion of other
R systems. Because a failure of a stick shaker is apparent to
R the flight crew when tested before each flight the need of a
R fault indicator for the stick shaker is not required.

FCES FIM Indicators
Table 3

NAME	LOCATION	CONTROLLING SUBSYSTEM		
		DLC/AGS	STALL WARNING	PFCS MONITOR
ANGLE OF ATTACK 1	FCES	-	X	-
ANGLE OF ATTACK 2	FCES	-	X	-
DLC SERVO 1	FCES	X	-	-
DLC SERVO 2	FCES	X	-	-
DLC SWITCHES	FCES	X	-	-
FCES COMPUTER	FCES	X	X	X

B. ANGLE OF ATTACK 1 and 2 FIM (Ref. Fig. 20)

(1) Fault Detection

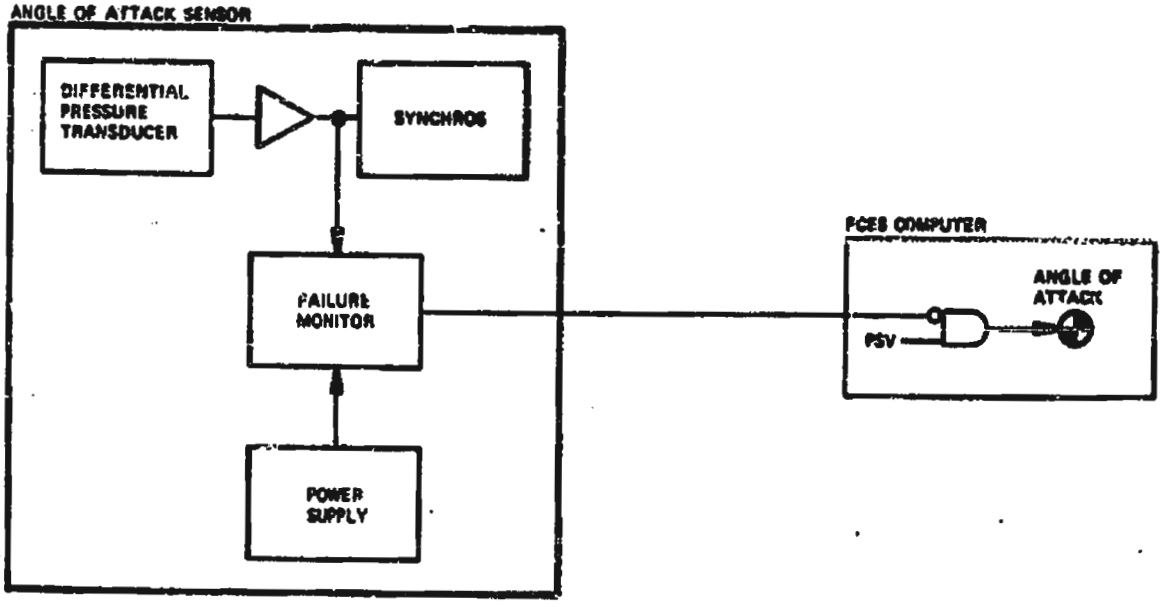
There are two Angle of Attack (AOA) sensors utilized on the L-1011, one on each side of the aircraft. Both AOA sensors provide validity signals to the FCES computer indicating the AOA sensor is powered, and operating correctly. If the AOA loses power, has a failure in the electronics, or has a mechanical problem; the AOA validity will go away. The absence of the AOA validity will cause the corresponding ANGLE OF ATTACK fault indicator to be activated (shown in Figure 20) provided the AOA fault indicator enable logic is fulfilled.

(2) Enable Logic

For the AOA fault indication to be enabled 115V ac power has to be applied to both channels of the FCES computer, 28V dc unregulated power has to be applied to the computer, the 26V ac transformers in the FCES computer has to be good, and both FCES power supply monitors have to be valid (indicating 28V dc, 12V dc, and 5V dc power supplies valid).

(3) Flight Station Indications

When the ANGLE OF ATTACK fault indicator trips, the following flight station indications will occur.



ABBREVIATIONS:

PSV = POWER SUPPLIES VALID (POWER SUPPLY MONITORS VALID AND ALL POWER TO FCES COMPUTER)

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Angle of Attack FIM
Figure 20

EFFECTIVITY: ALL

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R • The FLT CONT PANELS legend on the caution and warning panel will illuminate.

R • The STALL WARN FAIL legend will illuminate on the appropriate switch (i.e., AOA No. 1 FAILED STALL WARN 1 FAIL light) on the overhead FCES control panel.

R • If the speed control system is in the stall margin mode, the appropriate ATS FAIL light will illuminate on the FCES control panel.

R C. DLC SERVO 1 and 2 FIM (Ref. Fig. 21)

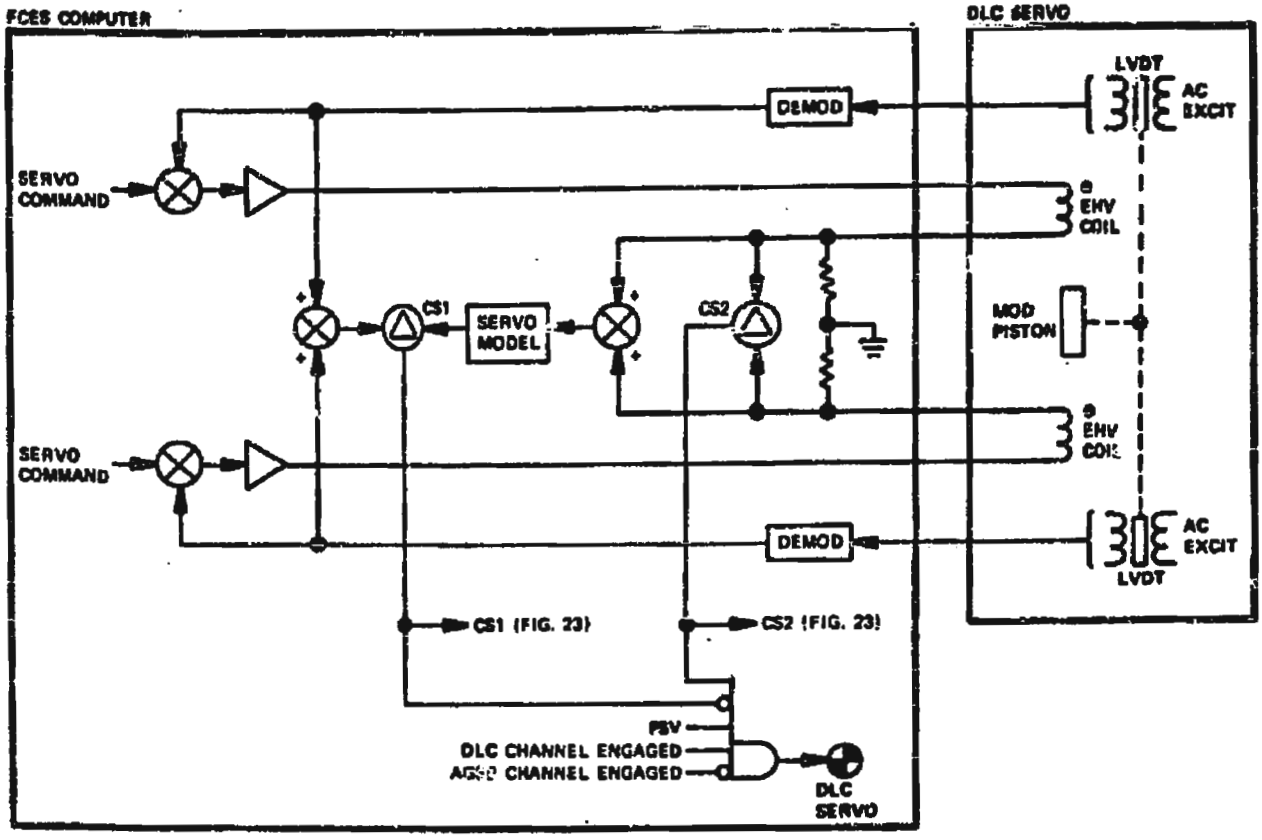
R (1) Fault Detection

R The DLC servo is monitored by the servo rate comparator (CS1) in the FCES computer. With the servo FIM circuits enabled, a significant difference between the commanded (via servo model) and achieved servo rate (feedback) will result in display of DLC SERVO fault indication on the FCES computer and automatic servo disengagement. The servo rate comparator will detect servo (servo jam or runaways) and/or servo model (computer) failures. Further, the comparator will detect other faults that are equivalent to a servo jam or runaway; i.e. hydraulic loss, manual override (via speed brake lever), LVDT jam, engage solenoid, etc.

R The inputs to the servo model are monitored by the servo command comparator (CS2). Therefore, a servo fault or equivalent is more probable than a servo model fault; since it is a very simple electronic network. Thus, when the DLC SERVO fault indicator is tripped, the servo or equivalent is usually at fault.

R (2) Enable Logic

R The enable logic is designed to minimize spurious DLC SERVO fault indications by limiting the indicator to specific conditions; i.e. modes of operation, computer power status, servo commands and aircraft configuration. The DLC SERVO fault indicators are enabled when the following conditions are satisfied; associated DLC channel is engaged, associated channel is not in automatic ground speed brake (AGSB) mode, FCES computer power supplies are valid, and servo command comparator (CS2) is valid. Utilization of DLC engage logic limits the FIM indications to the aircraft configuration (APPROACH) where the servo is being controlled automatically. The AGSB mode logic inhibits spurious FIM indications that would occur when the



ABBREVIATIONS:
AGSB = AUTOMATIC GROUND SPEED BRAKES
CS1 = SERVO RATE COMPARATOR
CS2 = COMMAND COMPARATOR
DLC = DIRECT LIFT CONTROL
PSV = POWER SUPPLIES VALID

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DLC Servo FIM
Figure 21

EFFECTIVITY: ALL

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R servo is being automatically operated outside the
R linear range of the LVDT feedback transducers. The
R servo command comparator (CS2) monitors the servo EHV
R (electro-hydraulic valve) coil current commands. Note,
R that the same input commands to the EHV are utilized by
R the servo model. Any difference between coil currents
R will cause a comparator trip and automatic servo
R disengagement. The trip signal is utilized to detect a
R computer fault and inhibit the DLC SERVO fault
R indicator, since a significant difference in coil
R currents is most probably due to a malfunction in the
R computer electronics rather than the very reliable EHV
R coils.

R (3) Flight Station Indications

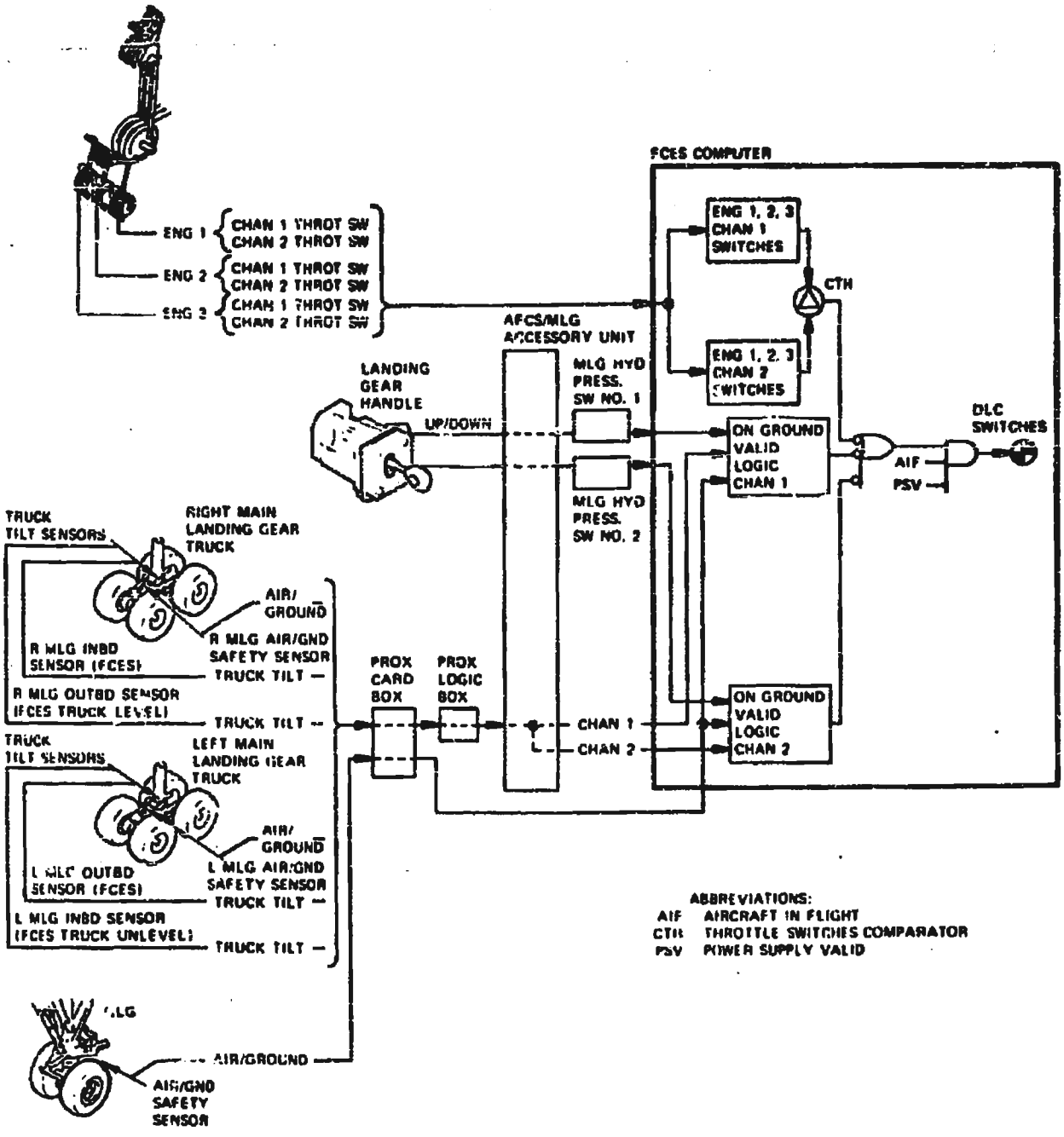
R The DLC SERVO fault indicator annunciation is
R accompanied by a DLC/AUTO SPLR FAIL indication on the
R FCES control panel: DLC SERVO 1 fault indication with
R DLC/AUTO SPLR 1 FAIL, and DLC SERVO 2 fault indication
R with DLC/AUTO SPLR 2 FAIL.

R D. DLC SWITCHES FIM (Ref. Fig. 22)

R (1) Fault Detection

R There are many switches utilized in the Direct Lift
R Control (DLC) system to provide logic for DLC and
R Automatic Ground Speed (AGS) Brake operation. There
R are switches located in the throttle quadrant, used to
R monitor throttle lever position, that provide the
R throttle to the FCES computer. There are switches on
R the main landing gear used to monitor weight on the
R landing gear and truck tilt. Truck tilt is the angle
R to which the landing gear goes in reference to the
R fuselage when the main landing gear touches ground with
R the nose in the air. There are switches on the nose
R landing gear used to monitor when the nose gear is on
R the ground. There are switches in the hydraulic system
R also used by the FCES computer for the DLC/AGS system.
R These switches are used to tell if hydraulic pressure
R is available to the landing gear for landing gear
R operation.

R All of the switches mentioned above are monitored by
R the DLC switches FIM Logic and if disagreement occurs,
R the DLC SWITCHES fault indicator is tripped when the
R enable logic is present (Ref. Fig. 22). There are
R three different fault paths that can cause the DLC
R SWITCHES fault indicator to indicate a fault when the
R enable logic is present. They are on ground valid



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R DLC SWITCHES FIM
R Figure 22

R EFFECTIVITY: ALL
R
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R logic 1, on ground valid logic 2, and throttle switch
R comparison.

R The on ground valid logic No. 1 signal compares truck
R tilt switches left and right MLG, air/ground switches
R left and right MLG, the hydraulic pressure switches,
R and the nose gear air/ground switches for Channel one.
R If any of these switches are in disagreement with the
R others after a 12 second time delay the fault path will
R indicate a fault.

R The on ground valid logic No. 2 signal performs the
R same function for channel 2.

R The throttle switch comparator (CTH) is the third fault
R path used to set the DLC SWITCHES fault indicator when
R the enable logic is fulfilled. This comparator
R compares the throttle switches feeding channel one of
R the FCES computer with the throttle switches providing
R inputs to channel 2 of the FCES computer. With all the
R switches operating correctly, the amount of closed and
R open switches in channel one and channel two will be
R the same. If one switch fails, the two channels will
R be in disagreement and the throttle comparator will
R indicate a failure through the DLC SWITCHES fault
R indication (if the enable logic is present).

R A DLC SWITCHES fault indication does not necessarily
R mean that a switch has failed. As can be seen from
R Figure 22, failures in the wiring, failures in the
R AFCS/Main landing gear accessory unit, failures in the
R proximity logic box, failures in the proximity card
R box, and failures of landing gear sensor can all cause
R the DLC SWITCHES fault indicator to indicate a fault.
R The problems exist for the throttles, nose gear, and
R pressure switches also.

R (2) Enable Logic

R For the DLC SWITCHES fault indicator to be enabled, two
R conditions have to be met. The FCES computer power
R supplies have to be valid (PSV) and the aircraft has to
R be in the air (AIF).

R For the power to be valid, 115V ac has to be applied to
R both channels of the FCES computer, 28V dc unregulated
R has to be applied to the FCES computer, the 26V ac
R transformers in the FCES computer have to be good, and
R both FCES computer power supply monitors have to be
R valid. If both power supply monitors are valid, the
R 28V dc, 12V dc, and 5V dc power supplies are operative
R and within tolerance.

R The second enable condition is the requirement for the
R aircraft to be in the air. When the aircraft is on the
R ground, hydraulic pressure can be turned off which
R would cause the DLC SWITCHES fault indicator to
R indicate a failure if the aircraft in flight signal was
R not a part of the enable logic.

R (3) Flight Station Indications

R When the DLC SWITCHES fault indicator is annunciated
R the following flight station indications may occur.

R • The FLT CONT PANELS legend on the caution and
R warning panel may illuminate.

R • The DLC/AGS FAIL LEGEND on the appropriate
R switch of FCES panel may illuminate.

R There are some DLC switch failures that can cause a DLC
R SWITCHES fault indication and not have a flight station
R indication. This is done because the system is still
R operative, and the DLC SWITCHES fault indication
R indicates the failure.

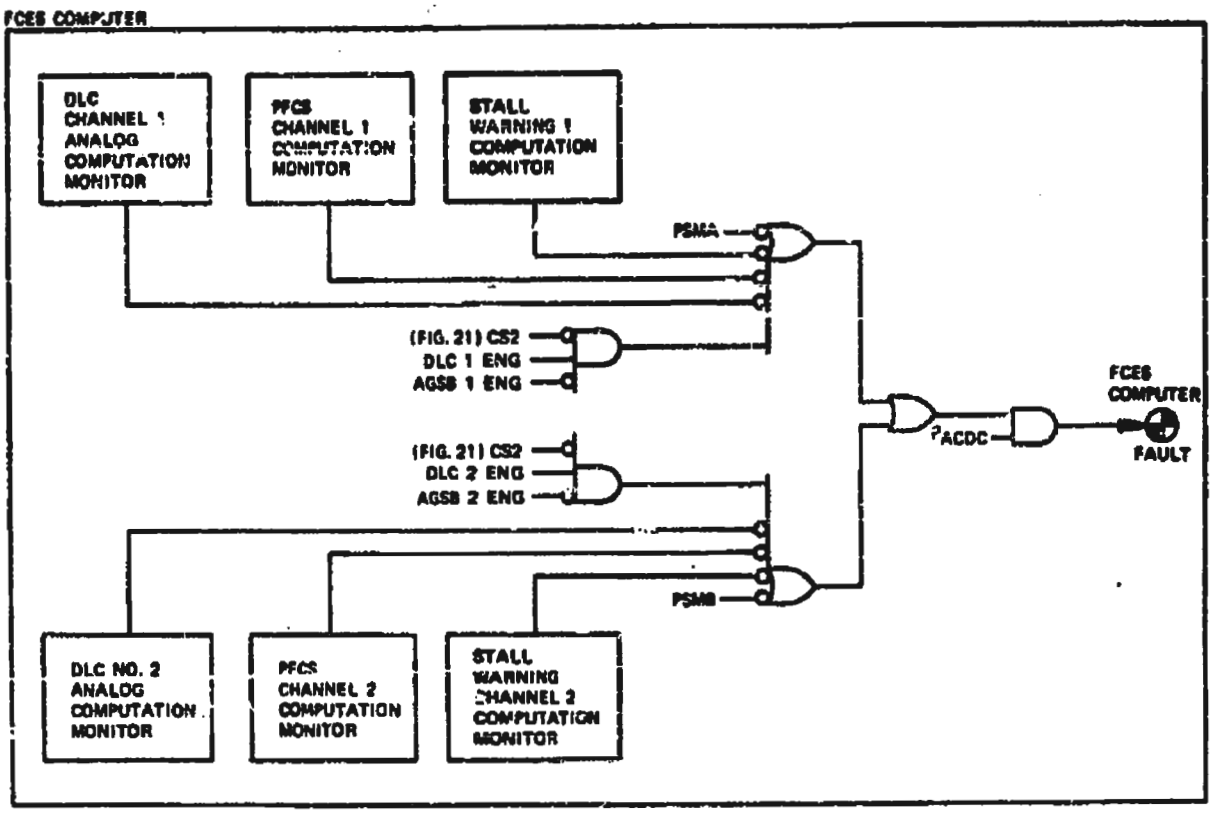
R E. FCES Computer Fault FIM (Ref. Fig. 23)

R There are numerous fault conditions that will annunciate a
R FCES computer fault when a fault in the FCES circuitry is
R detected. Failures in channel 1 or channel 2 of the Direct
R Lift Control (DLC) analog monitor, the DLC command
R comparator, the Primary Flight Control System (PFCS)
R monitor, the stall warning computation monitor, or the FCES
R power supply monitor will cause the FCES computer fault
R indicator to annunciate when the appropriate enable logic is
R present.

R (1) Fault Detection

R The computer subsystems which give fault detection
R follow:

R • DLC ANALOG COMPUTATION MONITOR - DLC
R computation channels 1 and 2 each have two analog
R computation subchannels. The DLC analog
R computation monitor detects a difference between
R these two analog subchannels and indicates a
R failure when the difference is greater than the
R specified value (2V dc). The DLC analog
R computation monitor will also indicate a fail if
R the two subchannels disagree in the requirement
R for DLC being activated and ground speed brakes
R being inactive.



ABBREVIATIONS:

P_{ACDC} = BOTH CHANNELS OF 26V AC AND UNREGULATED 28V DC GOOD
CS2 = COMMAND COMPARATOR
PSMA = POWER SUPPLY MONITOR VALID A
PSMB = POWER SUPPLY MONITOR VALID B

EM1-0100-22-483

R R FCES Computer Fault FIM
Figure 23

R R 001B EFFECTIVITY: ALL

Both analog subchannels of a DLC channel derive their information from the same sensors. Since the only difference in the subchannel computations is the electronics in the computer, differences in the outputs can be attributed to the computer. These differences when above a certain value are then displayed as a computer fault when the enable logic is present.

- DLC COMMAND COMPARATOR (CS2) - The DLC command comparator compares the coil current from the EHV coils in the DLC servo. If the current in the two subchannels differ by a specified amount and either DLC or ground speed brakes are engaged, the DLC command comparator will trip the FCES computer fault indicator when the enable logic is present. The coil current can be in disagreement because of a wiring problem or a bad coil, but the most probable cause is a bad FCES computer.

- PFCS MONITORING COMPUTATION MONITOR - The PFCS monitoring channel monitor provides an input to the FCES computer fault indicator also. This monitor looks at the pitch and roll PFCS monitoring systems (for the associated channel) to see if the system is operating normally.

The PFCS monitoring system is designed such that a jam in the pitch or roll axis will cause appropriate lights to illuminate in the flight station. If a jam occurs, only the side with the jam should have a flight station indication. If a jam is indicated on the other side as well there is a problem in the PFCS monitoring system and the computer fault indicator is annunciated.

In flight, the indication of a jam on the Captains or First Officers side is not possible with a completely operative PFCS monitoring system. For this reason, on occurrence of jam indications on the Captains and First Officers side a computer fault is annunciated when the enable logic is satisfied.

During functional testing of the PFCS monitoring system, it is possible to trip the computer fault indicator. This is not normal operation and will only occur because of the functional testing procedures.

R • STALL WARNING COMPUTATION MONITOR - The stall warning input to the FCES computer fault indicator is generated when the electronics in the stall warning system has failed. If the angle-of-attack sensor has failed or the FCES power monitor has failed the stall warning computation monitor is inhibited from indicating a failure.

The stall warning computation monitor will trip the computer fault indicator when angle-of-attack sensor is below eleven degrees and the electronics have failed and the enable logic is present.

R • POWER SUPPLY MONITOR - The FCES computer power supply monitor will cause the FCES computer fault indicator to trip when it detects a failure in one of the computer power supplies if the enable logic is present.

R (2) Enable Logic

For the FCES computer fault indicator to be enabled, only channel 1 and channel 2 26V ac and 28V dc (unregulated) must be present at the computer. If 26V ac is present the computer must be powered by aircraft power.

R (3) Flight Station Indications

When the FCES computer fault indicator is annunciated, the following flight station indications may occur:

R • The FLT CONT PANELS legend on the caution and warning panel will illuminate.

R • The DLC/FAIL legend (1 or 2) on the FCES panel may illuminate.

R • The stall warning FAIL legend (1 or 2) on the FCES panel may illuminate.

R • The altitude alert flag on the ALT SELECT panel may come into view.

R • The PFCS MONITOR PITCH FAIL legend (1 or 2) on the PFCS panel may illuminate - This can be accompanied by an illogical combination of Captains and First Officers STABILIZER PUSH lights on the PFCS panel.

R • The PFCS MONITOR ROLL FAIL legend (1 or 2) on
R the PFCS panel may illuminate - This can be
R accompanied by an illogical combination of
R Captains and First Officers AILERON cross-hatched
R legends and/or SPOILER PUSH legends on the PFCS
R panel.

R • The AUTO GND SPLRS INOP legend on the caution
R and warning panel may illuminate.

R 5. Trim Augmentation System

R A. General

R The FIM fault indicators that are set by the trim
R augmentation computer are AIR DATA INPUTS, CONTROL WHEEL 1,
R CONTROL WHEEL 2, ELEC FEEL & TRIM MECH on the FCES computer,
R and Computer Fault on the trim augmentation computer. The
R AIR DATA INPUTS fault indicator may also be set by the speed
R computer and by either one or both pitch computers.

R To avoid repetition, two comments with regard to enabling
R trim augmentation computer FIM fault indications are:

R (1) The AIR DATA INPUTS, CONTROL WHEEL 1, CONTROL WHEEL 2,
R and ELEC FEEL & TRIM MECH fault indicators are enabled
R only if the power supplies in the trim augmentation
R computer are valid.

R (2) All fault indicators are enabled only if both 28V dc
R aircraft supplies and both 26V ac supplies in the trim
R augmentation computer are good. Loss of any one of
R these power supplies for greater than three seconds
R will trip a latch which inhibits all FIM fault
R indicators until computer power is turned off. There
R are five basic areas monitored by the trim augmentation
R computers FIM system.

R These are:

R • Sensor signals that provide inputs to the pitch
R trim and feel systems.

R • The redundant computations by means of
R cross-channel monitors

R • The dc power supplies in each of the two
R channels including

R +5V dc regulated

R +5V dc special

R ±12V dc regulated

R ±28V dc regulated

R • The operational status of each of the six
R closed loop servos by means of in-line monitors,
R i.e., Mach Trim 1 & 2, Mach Feel 1 & 2, and Pitch
R Trim 1 & 2.

R • The six servo motor-tachometer generator
R assemblies in the electric feel and trim
R mechanism.

R B. AIR DATA INPUTS (Trim Aug) FIM (Ref. Fig. 24)

R The commands for the Mach Trim and Mach Feel Systems emanate
R from two air data computers (ADC). ADC 1 drives channel 1
R of these systems and ADC 2 drives channel 2. Each Mach
R signal is a dc voltage which is proportional to Mach, and is
R derived from a potentiometer in the ADC. The Mach servo in
R each ADC is in-line monitored to provide a Mach valid
R signal. The Mach valid signal is used by the associated
R Mach Trim and Feel systems to annunciate ADC status.

R (1) Fault Detection

R The AIR DATA INPUTS fault indicator is set whenever the
R difference between the two Mach signals is greater than
R the equivalent of 0.037 Mach, plus a time delay of 0.3
R second. It is also set whenever the Mach in-line
R monitor in either ADC detects a failure. Under either
R of these conditions, the Mach valid signal goes from
R 24V dc to zero.

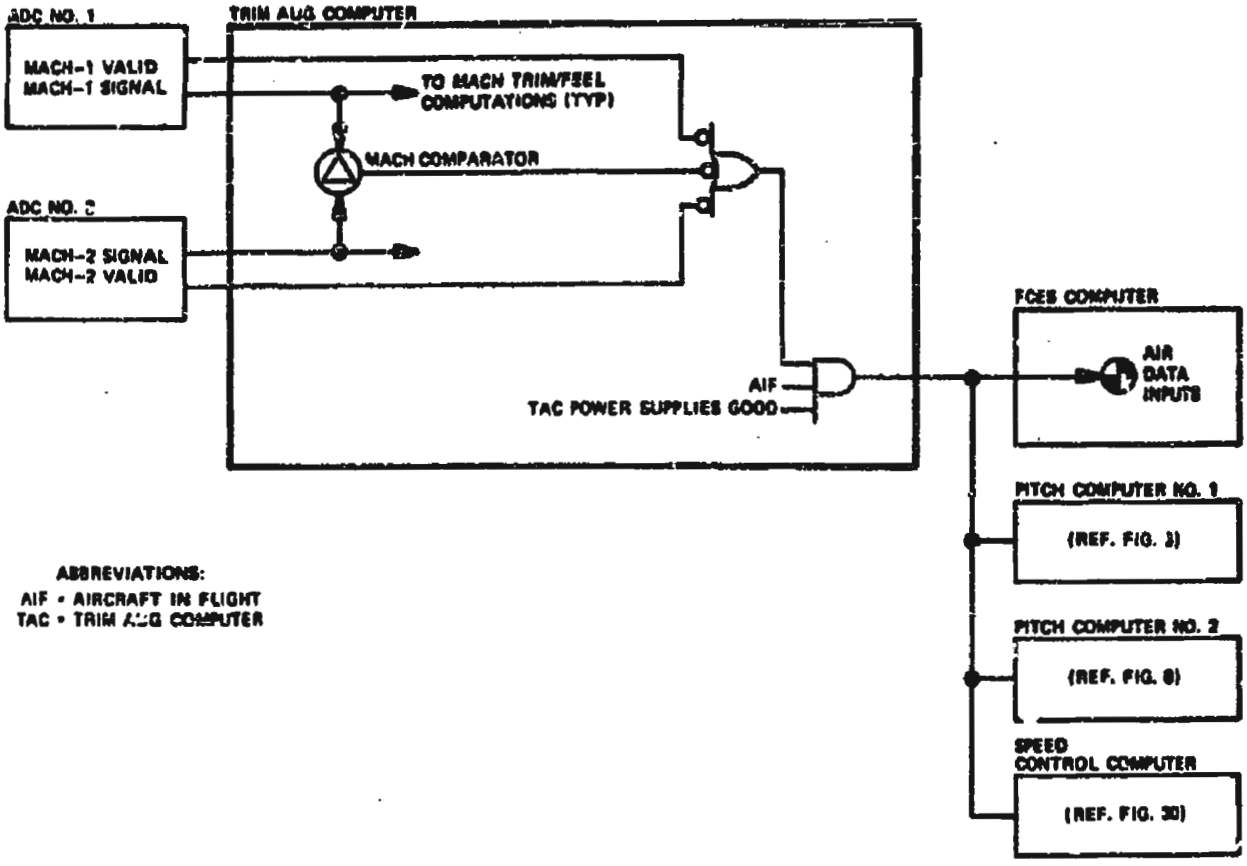
R (2) Enable Logic

R The AIR DATA INPUTS fault indicator is enabled whenever
R the aircraft is airborne, and all electrical power
R supplies associated with Mach Trim, Mach Feel, and
R Pitch Trim are valid. This fault indicator is also
R enabled as long as both 26V ac and both aircraft 28V dc
R supplies are good. Loss of any of these four supplies
R will set a latch that inhibits the fault indicator
R until system power is turned off.

R The AIR DATA INPUTS fault indicator is enabled only
R while airborne because on the ground, during ground
R checkout by maintenance personnel, it is possible to
R operate the ADCs independently, by use of either ADCs
R self test button. When this happens, the Mach valids
R go from 24V dc to zero, and in addition the Mach FIM
R comparator will trip as the two Mach number signals
R start to differ. Either of these events would, if not
R inhibited on the ground, cause a nuisance annunciation
R of the AIR DATA INPUTS fault indicator which could be
R misleading to ground personnel while troubleshooting.

R (3) Flight Station Indications

R Loss of either ADC Mach validity will cause the
R associated channel of Mach Trim and Mach Feel to



ABBREVIATIONS:
AIF = AIRCRAFT IN FLIGHT
TAC = TRIM AUG COMPUTER

EM1-0100-22-491

R Air Data Inputs (Trim Aug) FIM
R Figure 24

R EFFECTIVITY: ALL
R
001B

indicate FAIL on the FCES Panel; and on the caution and warning panel the FLT CONT PANELS legend will illuminate. That is if ADC 1 Mach validity goes from 24V dc to zero, then:

- Mach Feel 1 will indicate FAIL
- Mach Trim 1 will indicate FAIL
- Pitch autopilot A bathandle will drop from CMD to CWS, provided that the autopilot was engaged in the Mach hold mode, the CMD DISC message will be annunciated and the ALERT light on the AFCS WARNING indicator will flash.
- The command bars on the Captains flight director will be biased out of view if it had been engaged in the Mach hold mode.
- On aircraft equipped with AIDS, a record of ADC 1 Mach failure will be made on AIDS.

If ADC 2 Mach validity goes to zero, then

- Mach Feel 2 will indicate FAIL
- Mach Trim 2 will indicate FAIL
- Pitch autopilot B bathandle will drop from CMD to CWS, if the autopilot was engaged in the Mach hold mode
- The command bars on the First Officers flight director will be biased out of view if it had been engaged in the Mach Hold mode.
- If the aircraft is equipped with a rated EPR System, then the EPR flag on the TAT IEPR indicator will drop.
- On TWA aircraft, a record of ADC 2 Mach Failure may be made on AIDS, if the flag was down during the AIDS sampling time.

Failure of the ADCs Mach number signals to the trim augmentation computer to track will cause both channels of Mach Feel and Mach Trim to fail. The Mach Feel cross-channel comparator has a threshold which will trip at a smaller Mach number difference than will the Mach Trim cross-channel comparator. Therefore, Mach Feel may trip off before Mach Trim does, or Mach Feel

R may fail by itself within Mach Trim failure
R annunciation.

R C. CONTROL WHEEL 1 and 2 FIM (Ref. Fig. 25)

R The commands for the two channel manual/electrical trim
R system emanate from the two section tachometer generators in
R the outboard horn of each of the two control wheels. One
R section of the tachometer generator assembly drives trim
R channel 1, and the other section drives trim channel 2. The
R output of each section is a dc voltage proportional to the
R rate of rotation and is either positive or negative
R depending on direction of rotation.

R (1) Fault Detection

R The CONTROL WHEEL 1 fault indicator is set whenever the
R difference between the outputs of the two sections of
R the tachometer generator assembly in the captains
R control wheel exceeds 0.24 volts plus a time delay of
R 0.3 seconds. This voltage is equivalent to 0.54
R revolutions per second of the train thumb wheel. In
R the event of an open or shorted generator output, the
R fault indicator would be tripped when this rate is
R exceeded.

R (2) Enable Logic

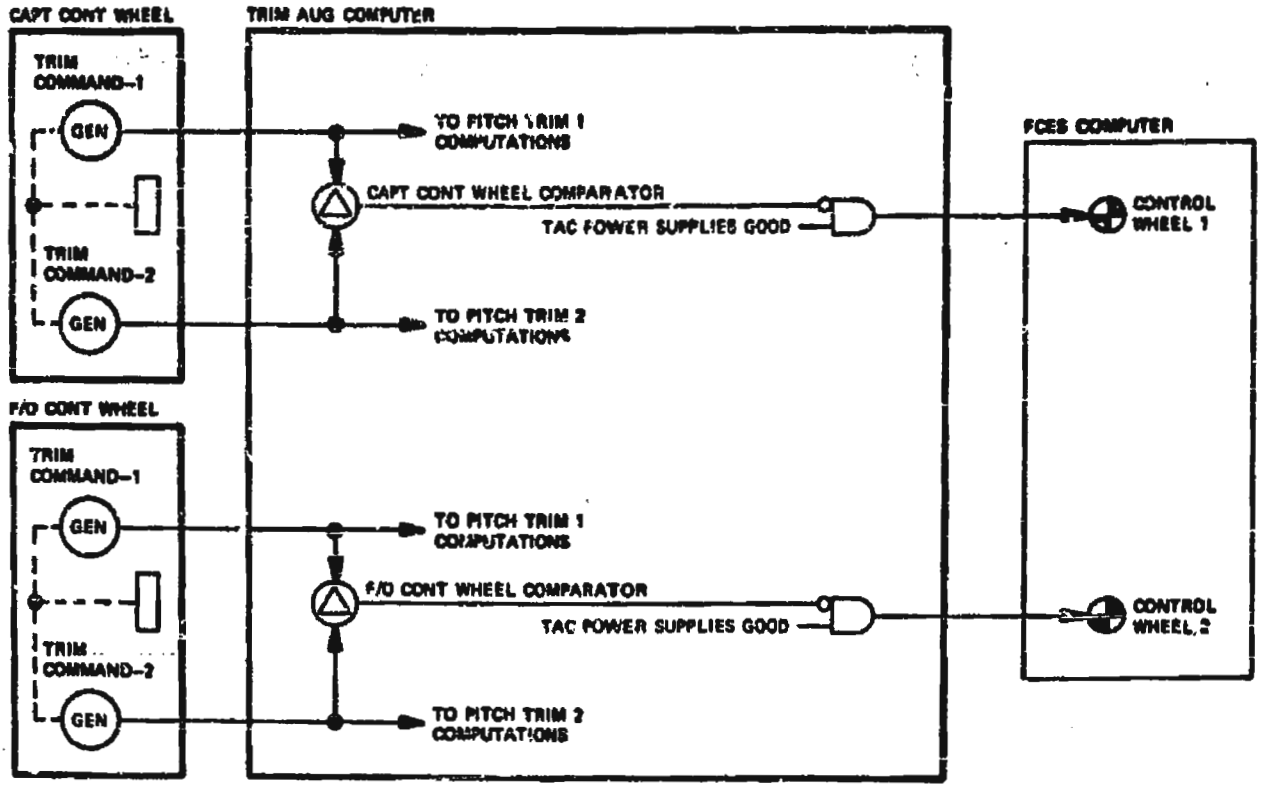
R The CONTROL WHEEL 1 fault indicator is enabled whenever
R electrical power is applied to the trim augmentation
R computer, if the channel 1 and 2 power supply monitors
R remain valid, and both 26V ac supplies and both
R aircraft 28V dc supplies remain valid. Engagement of
R the autopilot does not inhibit the fault indicator.
R Loss of either 26V ac or either 28V dc supplies will
R set a latch that will inhibit the fault indicator until
R system power is turned off.

R (3) Flight Station Indications

R During manual trim mode; that is, when the autopilot is
R not engaged, or if the autopilot is engaged and
R autotrim is inhibited; PITCH TRIM 1 & 2 FAIL legend on
R the FCES panel, and the FLT CONT PANELS legend will be
R illuminated on the caution and warning panel. FAIL
R annunciators will be annunciated, and the mechanical
R trim wheel in the center console will not be responsive
R to trim thumbwheel commands.

R Autotrim will be inhibited if:

R • The aircraft is on the ground



EM1-0100-22-402

Control Wheel FIM
Figure 25

EFFECTIVITY: ALL

001B

- The autopilot is in CWS mode with either a push or pull force on the control wheel in excess of four to eight pounds.

Under these conditions manual trim is enabled, and the above listed flight station indications apply.

(4) Control Wheel 2 FIM

Fault detection, enable logic, and flight station indications for CONTROL WHEEL 1 fault indicator are the same as for CONTROL WHEEL 2 fault indicator, except that the fault is isolated to the Second Officers control wheel.

D. ELEC FEEL AND TRIM MECH FIM (Ref. Fig. 26)

The commands for the six servo motor tachometer-generator assemblies in the electrical pitch feel and trim mechanisms emanate from the trim augmentation computer. The pitch trim 1 servo motor is driven by the channel 1 pitch trim servo amplifier, the pitch trim 2 servo motor is driven by the channel 2 pitch trim servo amplifier, and in a like manner the Mach Trim 1 and 2 and Mach Feel 1 and 2 servo motors are driven.

The tachometer generators associated with each of the above servo motors feed back to its respective channel an ac voltage proportional to the servo motor rate. The voltage is either in or out of phase with the excitation voltage, depending on direction of servo motor rotation.

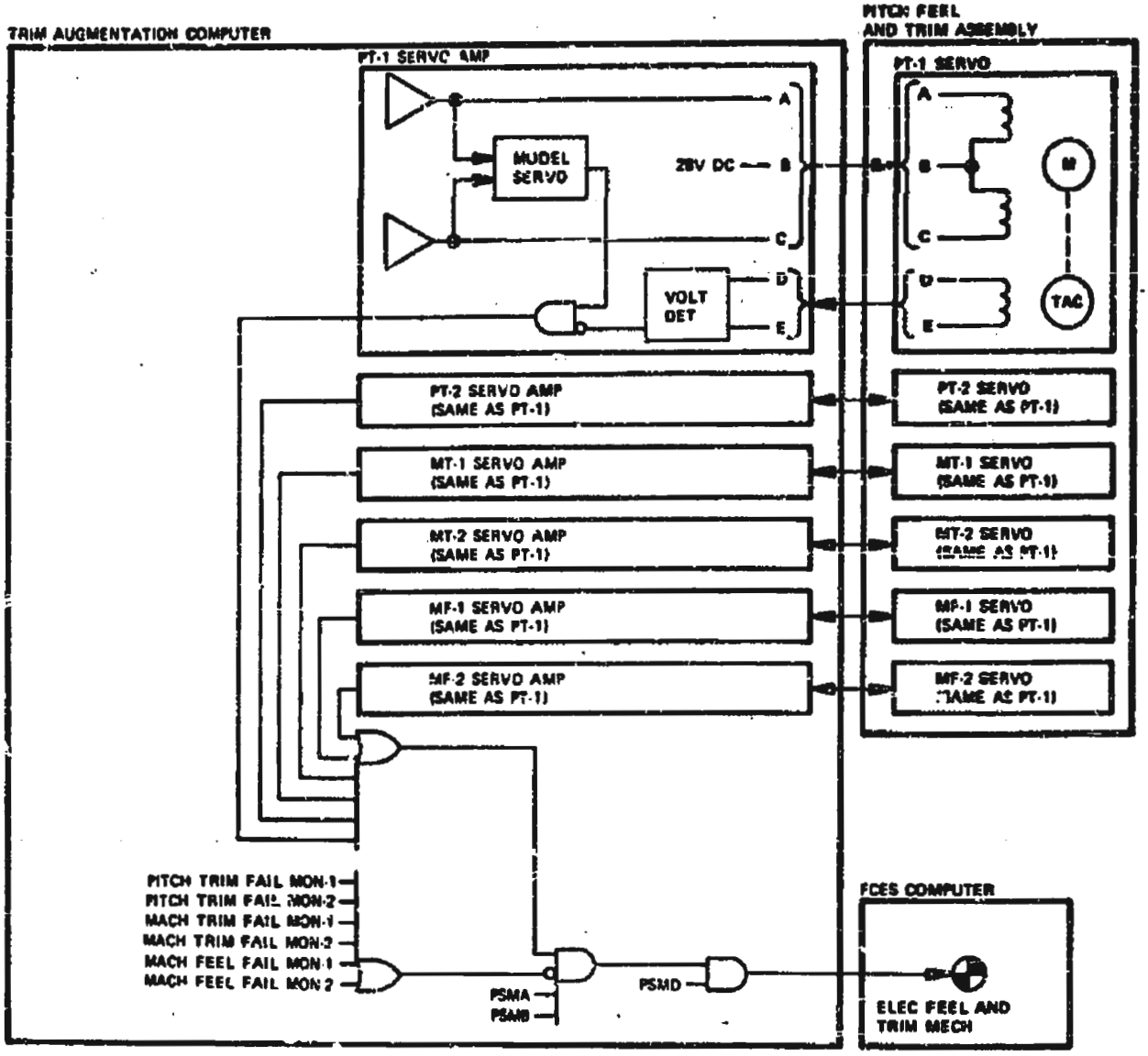
(1) Fault Detection

The ELEC FEEL & TRIM MECH fault indicator is set whenever there is no rate feedback from a tachometer generator in response to a motor drive command voltage from its respective servo amplifier if the fault has been detected by an associated monitor. Setting of the fault indicator is delayed 0.4 second subsequent to detection.

(2) Enable Logic

The ELEC FEEL & TRIM MECH fault indicator is enabled only if none of the twelve in-line monitors or six cross-channel monitors have tripped and all power supply valids are good.

(1) Flight Station Indications



ABBREVIATIONS:

PT = PITCH TRIM
MT = MACH TRIM
MF = MACH FEEL
PSM = POWER SUPPLY MONITOR
PSMD = DELAYED POWER SUPPLY MONITOR

EM1-0100-22-007

R Electric Feel and Trim Mechanical Assembly FIM
R Figure 26

R EFFECTIVITY: ALL
R
001B

R Failure of any one of the servo motor-tachometer generator assemblies will cause its associated FAIL annunciation on the overhead panels as shown below, and will also cause the FLT CONT PANELS legend on the caution and warning panel.

SERVO	ASSOCIATED OVERHEAD PANEL LEGEND
Mach Trim Servo 1	MACH TRIM 1 FAIL
Mach Trim Servo 2	MACH TRIM 2 FAIL
Mach Feel Servo 1	MACH FEEL 1 FAIL
Mach Feel Servo 2	MACH FEEL 2 FAIL
Pitch Trim Servo 1	PITCH TRIM 1 FAIL
Pitch Trim Servo 2	PITCH TRIM 2 FAIL

R E. Trim Augmentation COMPUTER FAULT FIM (Ref. Fig. 27)

R The commands for the trim augmentation fault indicator are derived from the twelve in-line and six cross-channel monitors as well as the power supply monitors in the trim augmentation computer.

R (1) Fault Detection

R The in-line monitors in each channel of the trim augmentation computer subsystems are used to detect failures in each servo loop. The cross-channel monitors are used to detect failures in the commands to each pair of servo loops.

R (2) Enable Logic

R The computer fault indicator is enabled under the following conditions:

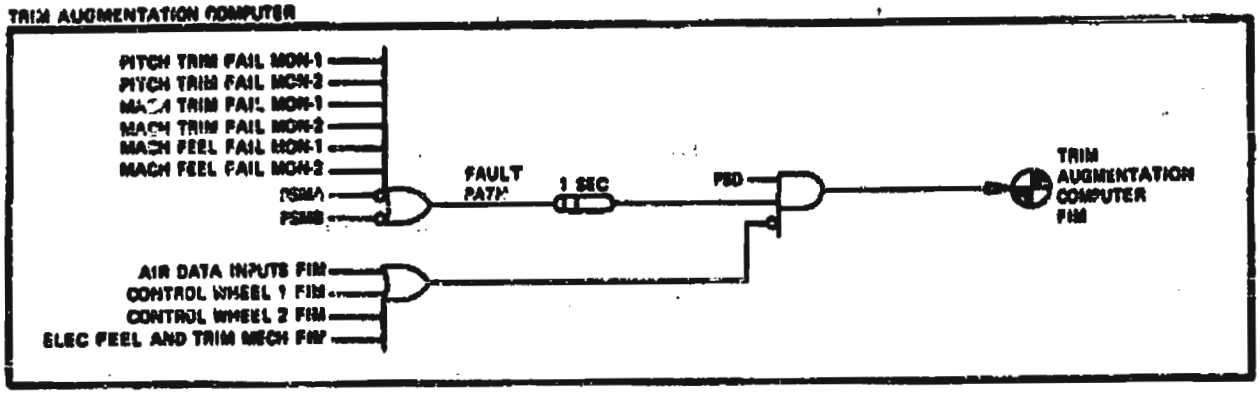
R • Both 26V ac reference valids are good

R • Both 28V dc aircraft supplies are good

R • No faults have been isolated by FIM to:

R CADC 1 or 2

R Captains or First Officers control wheel



ABBREVIATIONS:

PSD = DELAYED POWER SUPPLY MONITOR
PSMA = POWER SUPPLY MONITOR A
PSMB = POWER SUPPLY MONITOR B

EM1-0100-22-406

R Trim Augmentation Computer Fault FIM
R Figure 27

R EFFECTIVITY: ALL
R
001B

R Any of the six servo motor tachometer
R generator assemblies in the pitch feel and
R trim assembly.

R The enablement command from the in-line and
R cross-channel monitors is delayed by one second to
R allow sufficient time for the above FIM-detected faults
R to set their respective logic circuits. Then if these
R other logic circuits are set, the computer fault
R indicator will be inhibited for fault isolation to the
R proper line replaceable units.

R (3) Flight Station Indications

R Any one or none of the following overhead panel legends
R may be illuminated if there is a failure in the trim
R augmentation computer. The FLT CONT PANELS legend on
R the caution and warning panel will also be illuminated
R when one or more of the following legends are
R illuminated.

R MACH TRIM 1 FAIL	MACH TRIM 2 FAIL
R MACH FEEL 1 FAIL	MACH FEEL 2 FAIL
R PITCH TRIM 1 FAIL	PITCH TRIM 2 FAIL

6. Speed_Control_System

A. General

The speed control system (SCS) FIM consists of the speed control computer and the FCES computer. Table 4 lists the name of the location of the FIM indicators generated in the speed control computer.

The basic condition for the speed control system FIM to be active is that 115V ac be applied to the computer. There are three basic areas monitored by the SCS FIM. They are:

- Sensor signals that provide input to the speed control computer.
- The electronics in the speed control computer.
- The autothrottle servo.

The sensor signals which are set by the speed control computer are the AIR DATA INPUTS and the LONG. ACCEL fault indicators. The AIR DATA INPUTS fault indicator is also triggered by the trim augmentation computer and the pitch computers.

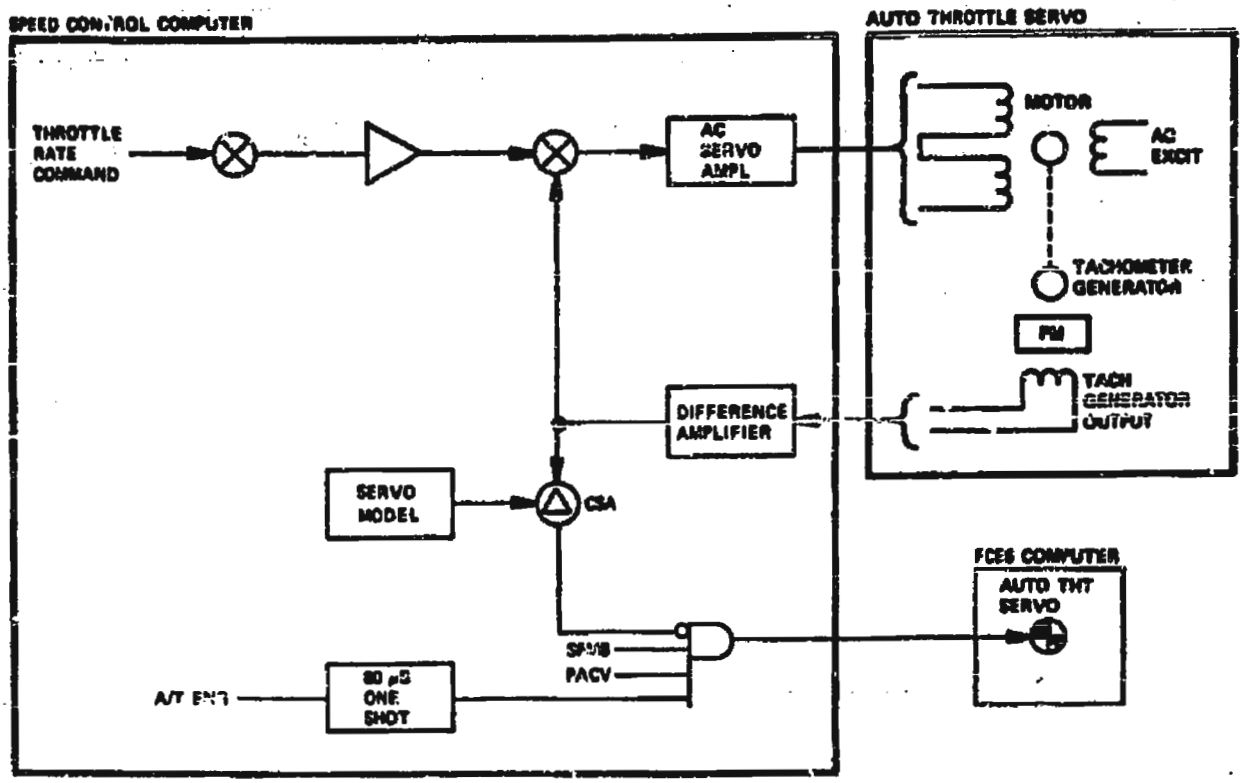
A failure of the computational channels of the speed control computer will be indicated by a speed control computer fault indicator, while a failure in the autothrottle servo will be indicated by a AUTO THT SERVO fault indicator.

The angle of attack (AOA) sensor provides inputs to the speed control system but AOA fault indication is not provided by the speed control computer. Since the stall warning subsystem of the FCES computer has the same inputs, the AOA fault indication is generated in the FCES computer.

Speed Control FIM Indicators
Table 4

NAME	LOCATION	CONTROLLING COMPUTER
AUTO THT SERVO	FCES Computer	SCS Computer
LONG. ACCEL	FCES Computer	SCS Computer
AIR DATA INPUTS	FCES Computer	SCS Computer
SCS COMPUTER	SCS Computer	SCS Computer

B. AUTO THT SERVO FIM(Ref. Fig. 28)



ABBREVIATIONS:

CSA = SERVO MONITOR COMPARATOR
A/T ENG = AUTO THROTTLE ENGAGED
PACV = 26V AC ØA AND B PRESENT
SPMB = SERVO POWER PRESENT

EM1-0100-22-007

R Automatic Throttle Servo FIM
R Figure 28

R EFFECTIVITY: ALL
R
001B

R (1) Fault Detection

R The AUTO THT SERVO fault indicator is activated by a servo
R monitor comparator in the speed control computer provided
R the enable logic is present.

R The servo monitor comparator (CSA in Figure 28) compares the
R actual throttle motor speed to that of an electronic model
R of the servo. If the output of the motor differs from that
R of the model by more than 800 RPM the fault detection
R circuit is activated causing the AUTO THT SERVO fault
R indicator to trip if the enable logic is present.

R The autothrottle servo fault detection circuit may trip for
R failure other than a servo failure. Failures in the AC
R servo amplifier, the differental amplifier, portion of the
R electronic math model, or aircraft wiring can cause the AUTO
R THT SERVO fault indicator to annunciate falsely. The
R failure rate of the wires and electronics is much lower than
R the autothrottle servo. Because of this difference,
R annunciation of the AUTO THT SERVO fault indicator will be a
R true servo failure the majority of the time.

R (2) Enable logic

R The atuothrottle servo fault detection circuitry will not be
R able to activate the AUTO THT SERVO fault indicator unless
R the following enable logic is present.

R • Power is applied to the autothrottle servo.

R • 26V ac phase A and B is present to the speed
R control computer.

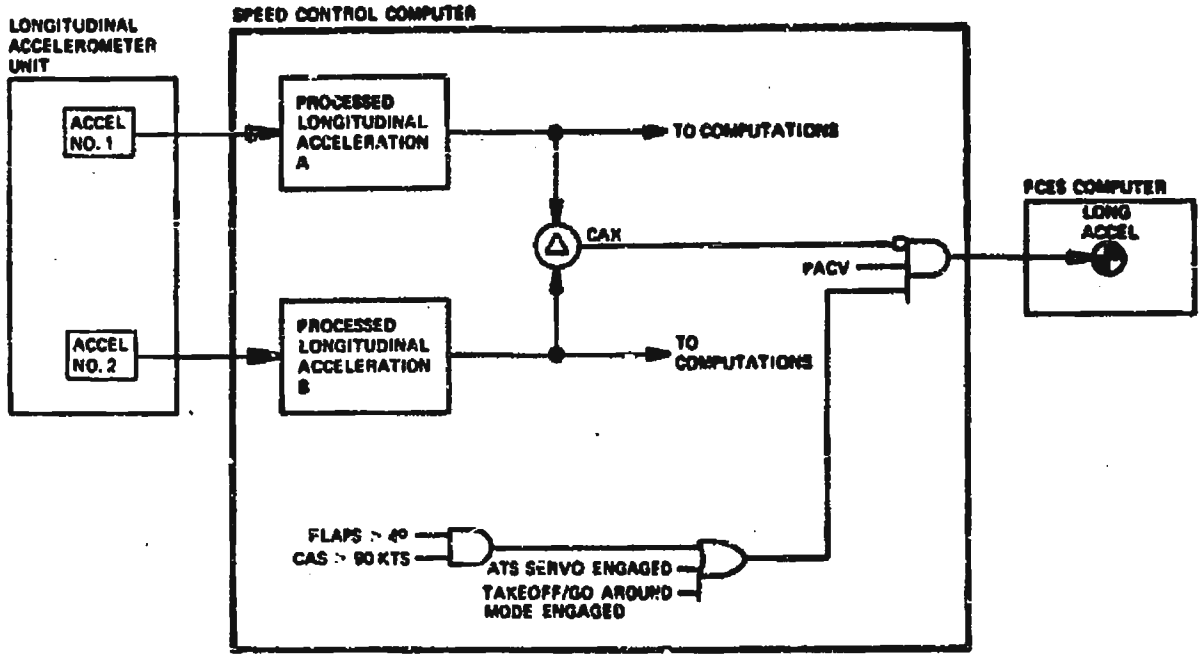
R • The autothrottle has not been engaged for less
R than 80 milliseconds. This delay allows the
R autothrottle servo to overcome the friction
R necessary in starting the servo which cannot be
R duplicated by the math model.

R (3) Flight Station Indications

R When the AUTO THT SERVO fault indicator is annunciated, the
R FLT CONT PANELS legend on the caution and warning panel will
R annunciate. Accompanying this light will be the ATS FAIL
R lights on the FCES panel.

R If the autothrottle is engaged, the ATS bathandle will
R disengage and the ATS DISC message on the AFCS WARNING
R indicator will come into view.

R C. LONG ACCEL FIM (Ref. Fig. 29)



ABBREVIATIONS:
PACV = 25V AC @ A & B PRESENT
CAX = LONG. ACCELERATION COMPARATOR
CAS = COMPUTED AIRSPEED
> = GREATER THAN

EM1-0100-22-404

Longitudinal Accelerometer FIM
Figure 29

EFFECTIVITY: ALL

R (1) Fault Detection

R As indicated in Figure 29, the two longitudinal
R accelerometers are contained in a single package.
R Accelerometer No. 1 and 2 receive ±12V dc excitation
R from channels 1 and 2 of the speed control computer.
R Output signals from accelerometers No. 1 and 2 go to
R their respective channels in the speed control
R computer. With the LONG ACCEL enable logic fulfilled,
R a difference of more than 0.1g between processed
R longitudinal acceleration A and B will result in the
R display of a LONG ACCEL fault indication on the FCES
R computer.

R (2) Enable Logic

R The LONG ACCEL fault indicator is enabled when the
R speed control computer is powered and the speed control
R system is active. To sense that the computer is
R powered, 26V ac, phases A and B are monitored in the
R computer.

R To determine that the speed control system is active,
R one of the following three conditions has to be
R fulfilled:

R • Airspeed greater than 90 knots and flaps
R greater than 4 degrees

R • Autothrottle servo engaged

R • Takeoff/go-around mode engaged

R (3) Flight Station Indications

R When a failure is annunciated by the LONG ACCEL fault
R indicator, the following flight station annunciations
R should occur:

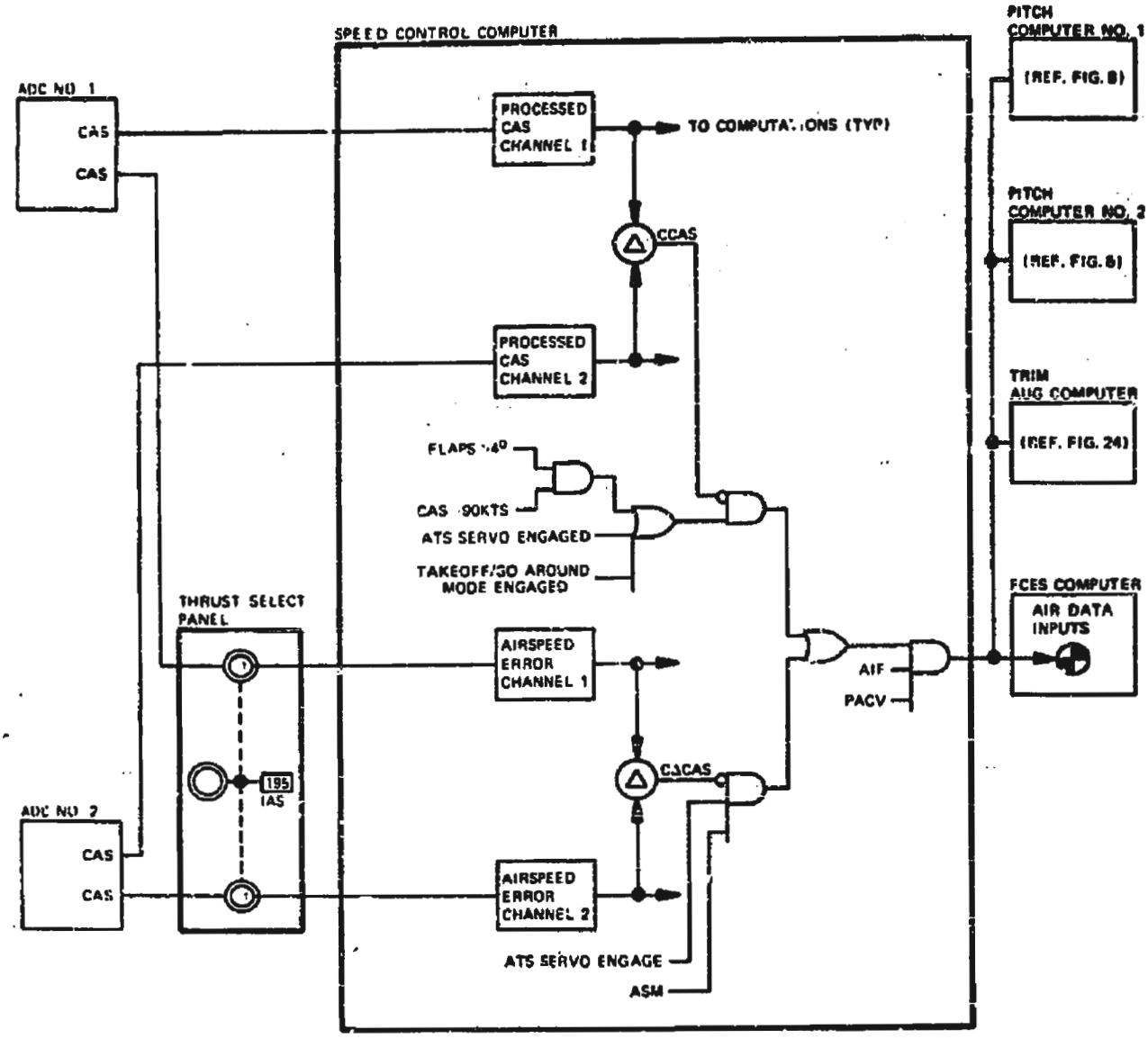
R • FLT CONT PANELS legend on caution and warning
R panel

R • ATS FAIL legend on FCES panel

R • ATS bat handle may drop to OFF, if engaged

R • ATS DISC message on AFCS WARNING indicator may
R come into view

R D. AIR DATA INPUTS (Speed) FIM (Ref. Fig. 30)



ABBREVIATIONS

AIF	AIRCRAFT IN FLIGHT
CCAS	COMPUTED AIRSPEED COMPARATOR
CSCAS	COMPUTED AIRSPEED ERROR COMPARATOR
ASM	AIR SPEED MODE ENGAGED
PACV	26v AC O A & B PRESENT GREATER THAN

EM1-0100-22-485

R Air Data Inputs (Speed) FIM
R Figure 30

R EFFECTIVITY: ALL
R
001B

The speed control computer provides an input to annunciate the AIR DATA INPUTS fault indicator, as does the pitch and trim augmentation computers. There are two fault detection circuits for the AIR DATA INPUTS fault indicator in the speed control computer.

R The two CADC and the thrust panel provide inputs to the speed control computer as sensors. These inputs are then used to display to the flight crew the airspeed status as compared to a selected airspeed or to drive the autothrottle servo to the selected value on the thrust panel.

(1) Fault Detection

The first fault detection circuit is mechanized to detect differences in the airspeed error between Channel 1 and Channel 2 of the speed control computer. The airspeed error is the error between the airspeed selected by the thrust panel and the actual airspeed as
R computed by the CADC.

This fault detection circuit is a comparator (Delta CAS) that will trip when the airspeed error between the two channels differ by more than three knots. The fault detection circuit can only be tripped if the appropriate enable functions are present. Tripping of this fault detection circuitry can be caused by problems in the CADC, the thrust select panel, the aircraft wiring, or the speed control computer. Failures in aircraft wiring or in the speed control computer that can cause this fault indicator to annunciate are remote and therefore the AIR DATA INPUTS fault indicator will indicate a CADC or thrust panel problem.

The second fault detection circuit is mechanized to detect differences in the processed computed airspeed (CAS) between Channel 1 and Channel 2 of the speed control computer. This fault detection circuit is a comparator (CCAS) that is activated to annunciate on AIR DATA INPUTS fault indicator when the appropriate enable functions are present. The comparator will indicate a failure when the processed CAS signals from Channel 1 and 2 disagree by more than 10 knots. Failures in the CADC, failures in the aircraft wiring or failures in the speed control computer can activate CCAS; although failures in the CADC are the most probable, the others remote.

(2) Enable Logic

The two fault detection comparators (C Delta CAS and CCAS) have enable functions that are common and enable functions that are independent. The common enable functions are the aircraft in flight and the speed control computer powered. With the aircraft on the ground, the air data inputs to the speed control computer will be invalid because of differences in air pressure at the pitot tubes. These pressure differences can cause the two CADCs to differ by values large enough to trip comparators C Delta CAS and CCAS. The speed control computer has to be powered to ensure that power transients will not cause the air data inputs fault indicator to annunciate. If 26V ac is available to both channels of the speed control computer, the computer is powered. Therefore this is used as an enable functions.

The C Delta CAS comparator has enable logic that is required only by C Delta CAS for it to be enabled (provided the common enable logic is present). The C Delta CAS comparator need only be valid when the autothrottles are trying to fly to an airspeed selected on the thrust panel. If the autothrottles are not driving to a selected airspeed, the comparator C Delta CAS need not be considered. For this reason, C Delta CAS can only be enable when the autothrottle servo is engaged and the speed control system is in the airspeed mode (as well as the common enable functions). The CCAS comparator will be active when the common enable functions are present and the CCAS enable functions are present. The CCAS should be active whenever the speed control system is active. For this reason when any of the following conditions exist, the CCAS will be enabled (the common enable logic is assumed to be present): The takeoff/go around mode, flaps greater than four degrees and airspeed greater than 90 knots, or engagement of the autothrottle servo. With any of these three conditions occuring and the common enable logic present, CCAS should give correct data as to the condition of the CADC.

R

(3) Flight Station Indications

When the AIR DATA INPUTS fault indicator trips through the speed control computer input, the following flight station indications will occur.

- The FLT CONT PANELS legend on the caution and warning panel will illuminate
- The ATS FAIL legend will illuminate on the FCES panel will illuminate

• The ATS bathandle will drop if it was engaged and the ATS DISC message will appear on the AFCS WARNING indicator.

E. Speed Control COMPUTER FAULT FIM (Ref. Fig. 31)

(1) Fault Detection

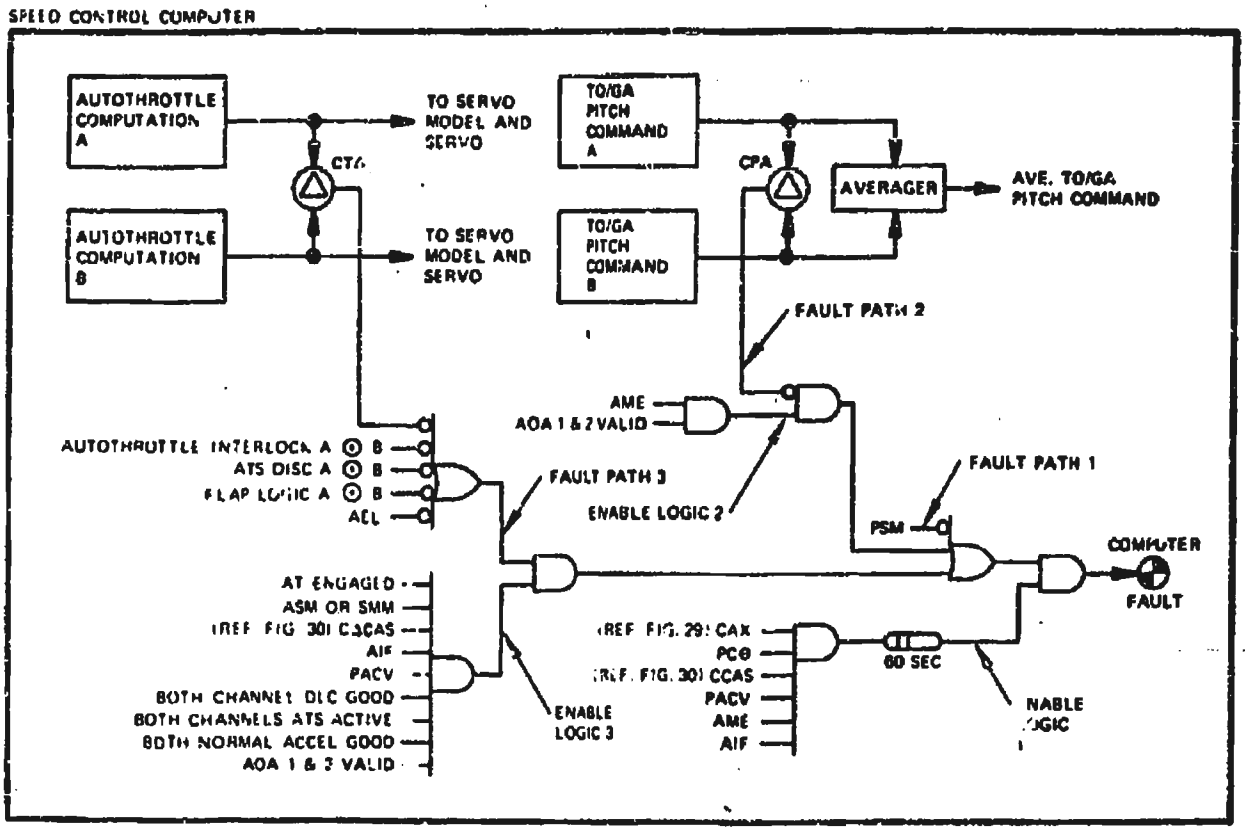
When the appropriate enable logic is present, the speed control system (SCS) computer monitors for invalid power supply voltages (Fault Path 1), for disagreements between channel A and channel B of the Takeoff/Go Around (TO/GA) pitch commands, and disagreements between channel A and channel B throttle rate commands and various autothrottle logic signals (fault Path 3).

Fault Path 1 will set a SCS computer fault indicator if enable logic 1 is present. For Fault Path 2 to trip the computer fault indicator, enable logic 1 and enable logic 2 has to be present. If enable logic 1 and Enable logic 3 is present, a fault detected by Fault Path 3 will trip the SCS computer fault indicator (see Figure 31). Fault Path 1 is the power supply monitor for the SCS computer. It will indicate a failure if the power supplies are out of specified limits and the appropriate enable logic is present.

Fault Path 2, as shown in Figure 31 is a comparator (CPS) which compares TO/GA pitch commands in channel A and channel B. If the channel A and channel TO/GA pitch commands disagree by more than four degrees, the comparator will trip and Fault Path 2 will be actuated.

Figure 31 shows the inputs that go into Fault Path 3. Fault Patch 3 is the path used to indicate failures in the SCS computer as detected by the autothrottle portion of the computer. Cross-channel comparator CTA compares the throttle rate commands from channel A and channel B of the autothrottle computation circuits. If the throttle commands disagree by more than 2.25 degrees, the comparator will trip causing the comparator fault indicator to annunciate, provided the appropriate enable logic is present.

Fault Path 3 has four other inputs which can cause the computer fault indicator to annunciate when enable logic 1 and enable logic 3 are present. Each of the four signals as derived from comparisons of logic from channel A and channel B of the autothrottle system. Autothrottle interlock is one of the logic signals. If channel A and channel B of the interlock logic is not in agreement, that is one channel indicates the autothrottle is engaged and the other indicates disengagement, Fault Path 3 will be activated.



ABBREVIATIONS:

AIF	AIRCRAFT IN FLIGHT
PACV	26V AC Φ A & B PRESENT
AME	FLAPS GREATER THAN 4° AND AIRSPEED GREATER THAN 90 KTS OR THE AUTOTHROTTLE ENGAGED OR TO/GA ENGAGED
PSM	POWER SUPPLY MONITOR
SMM	STALL MARGIN MODE
ASM	AIR SPEED MODE
CTA	AUTOTHROTTLE COMPUTATION COMPARATOR
CPA	PITCH COMMAND COMPARATOR
PCΘ	PROCESSED PITCH SIGNALS AGREE
CCAS	COMPUTED AIRSPEED COMPARATOR
CAX	LONG ACCELERATION COMPARATOR
CSCAS	AIRSPEED ERROR COMPARATOR
⊙	EXCLUSIVE OR
AEL	ATS ENG LOGIC DETECTS DISENGAGE AND THROTTLE CMD DRIVES THT PAST MAX + MIN

R R Speed Control Computer Fault FIM
Figure 31

R R EFFECTIVITY: ALL

001B

Engagement of the autothrottle is positive, and, if enable logic 3 is satisfied, disagreement between these signals indicates an SCS computer problem.

ATS disconnect is another signal that is compared and goes into making Fault Path 3. If the two channels are in disagreement (as in the autothrottle interlock signal), Fault Path 3 is then activated. This disagreement can be attributed to a SCS computer failure because both channels should be in agreement if enable logic 3 is fulfilled.

The third logic signal feeding Fault Path 3 is processed flap position. If enable logic 3 is valid, the processed flap position for channel A and channel B should be in agreement. If the two channels are in disagreement Fault Path 3 is activated. Failures in the flap power drive unit (PDU) could cause this failure but the predominant failure mode will be in the SCS computer.

The final logic signal contributing to Fault Path 3 is autothrottle servo enable logic. If the throttle command drives the throttles past the maximum or minimum thrust limits or the autothrottle engage logic detects autothrottle disengagement in either channel, Fault Path 3 will be activated.

(2) Enable logic

As noted above, there are three different circuits used to enable the SCS computer fault indicator Fault Paths. Enable logic 1 is needed for all three Fault Paths, enable logic 2 is needed for Fault Path 2, and enable logic 3 is needed for Fault Path 3.

Enable logic 1 has many inputs required before the SCS computer fault indicator can be annunciated. The aircraft has to be in flight. This ensures that wide differences in angle of attack (AOA) sensor outputs or differences in ADC outputs caused by low air flow will not affect the fault indicator. Another input necessary for enable logic 1 to be enabled is the presence of power to the computer. This is accomplished through the sensing of the 26V ac transformers in both channels of the SCS computer. Thus done, the computer fault indicator will not trip when the SCS computer circuit breaker is pulled.

Another input to enable logic 1 is the comparator CCAS. If this comparator is activated (see AIR DATA INPUTS), a failure in the air data system is detected. If a valid CCAS was not required for the SCS computer fault indicator, failures in the air data system would cause the SCS computer fault indicator to annunciate.

R Disagreements in processed acceleration could also cause the
R SCS computer fault indicator to annunciate because of
R differences in the two channels of the SCS computer even
R though the computer is good. To alleviate this problem, the
R processed acceleration comparator CAX has to be valid for
R enable logic 1 to be fulfilled.

R Processed pitch inputs also are inputs to enable logic 1.
R If these inputs agree, enable logic 1 can be valid. These
R signals assure that no failures in the pitch system can
R cause the SCS computer fault indicator to trip.

R The final input to enable logic 1 is used to assure that the
R speed control system is active. This input is any of the
R following present; autothrottle engaged, TO/GA engaged, or
R flaps greater than four degrees and airspeed greater than 90
R knots. If any of these modes are present, enable logic 1
R may be fulfilled.

R There is a 60 second time delay in the enable logic 1
R circuit to allow all systems time to settle down prior to
R enabling the SCS computer fault indicator.

R Enable logic 2 insures that Fault Path 2 will not cause
R nuisance trips when enable logic 1 is valid. The signals
R that make up enable logic 2 are both AOA/sensors operating
R correctly, as monitored by the AOA sensor validities; and
R the speed system in any of the following conditions;
R airspeed greater than 90 knots and flaps greater than four
R degrees, the autothrottle engaged, or TO/GA mode engaged.

R Enable logic 3 assures that nuisance trips of the SCS
R computer fault indicator will not occur when the
R autothrottle system is engaged. For this reason, enable
R logic 3 contains logic that assures the autothrottle is
R engaged and the autothrottle system is either in the air
R speed mode or the stall margin mode. With these signals
R present, the autothrottles may be engaged. To ensure that
R failures in DLC will not cause a SCS computer fault
R indication, both DLC channels have to be good for enable
R logic 3 to be valid.

R Another input to enable logic 3 is the state of both
R channels of the autothrottle system (ATS). If both channels
R of ATS are active enable logic 3 may be enabled. When the
R autothrottles are active, the autothrottle system will try
R to follow selected airspeed. If Comparator C Delta CAS (See
R AIR DATA INPUTS FIM, speed system) fails, an AIR DATA INPUTS
R fault indication should appear on the FCES computer. If C
R Delta CAS is tripped, the two channels of the autothrottle
R computation will be in disagreement and, without an inhibit,
R the SCS computer fault indicator would trip. To alleviate

this problem, C Delta CAS has to be valid for enable logic 3 to be enabled.

Other inputs to enable logic 3 are aircraft in flight, power to the computer, both normal accelerometers good, and both AOAs valid. Aircraft in flight assures that the airspeed errors at low speed will not affect the computation (C Delta CAS) and that the AOA sensors will be tracking; power to the computer assures that the computer logic in both channels will be active; both normal accelerometers good assures failures in the normal accelerometers will not cause an SCS computer fault indication; and both AOAs valid assures that differences in the autothrottle computation during the stall margin mode will not cause an SCS fault indication if an AOA sensor is indicating a failure.

(3) Flight Station Indications

When the speed control computer fault indicator trips the following flight station indications will occur.

- The FLT CONT PANELS legend on the caution and warning panel will illuminate.
- The ATS 'FAIL' legends on the FCES panel will illuminate (either 1, 2 or Both).
- The ATS Bathandle will drop to OFF if it was engaged and the ATS DISC message will appear on the AFCS warning indicator. Electrically the PLSA is located in series with the Flight Control Electronic (FCES) computer and the Yaw computer and, their secondary ac and dc supplied components.

AUTOPILOT - DESCRIPTION AND OPERATION

1. General

The autopilot consists of that portion of AFCS which automatically controls the pitch, roll and yaw axes of the aircraft. Various autopilot modes of operation can be selected to provide automatic control of the ailerons, elevator, rudder, and spoiler.

The autopilot consists of the following:

A. Autopilot Flight Director System (APFDS)

The APFDS operation is broken down into the pitch and roll axis used during normal flight. The following sections provide detailed description and operation:

Pitch axis operation. Refer to 22-11-00, Autopilot - Flight Director Pitch System.

Common pitch and roll axis operation. Refer to 22-12-00, APFDS Modes of Operation.

Roll axis operation. Refer to 22-13-00, Autopilot - Flight Director Roll System.

B. Yaw Stability Augmentation System (Yaw SAS)

R Yaw SAS provides yaw damping and turn coordination during normal flight. In the AUTOLAND mode, it provides runway alignment and rollout functions. The following section provides description and operation:

Yaw axis operation. Refer to 22-15-00, Yaw Stability Augmentation System.

C. Flight Control Electronics System (FCES)

The FCES operation is broken down into four systems used during normal flight. The following section provides detailed description and operation:

Stall warning system. Refer to 22-17-00, Flight Control Electronics System.

Altitude alert system. Refer to 22-17-00, Flight Control Electronics System.

R PFCS Pitch Axis Monitoring and Roll Axis Monitoring.
R Refer to 22-17-00, Flight Control Electronics System.

R Direct lift control/automatic ground spoiler system.
R Refer to 22-17-00, Flight Control Electronics System.

R D. Trim Augmentation System

R The trim augmentation system provides manual pitch trim, and
R automatic pitch trim while the autopilot is engaged. The
R following section provides a detailed description and
R operation:

R Manual and automatic pitch trim operation. Refer to
R 22-18-00, Trim Augmentation System.

R E. The following control panels, indicators and equipment
R common to autopilot operation are described in Paragraphs 2
R through 10.

R 22-10-01 APFDS Engage Panel

R 22-10-02 NAV MODE Select Panel

R 22-10-03 HDG/PITCH MODE Panel

R 22-10-05 AFCS MODES Annunciator Indicator

R 22-10-06 AFCS WARNING Indicator

R 22-10-07 FCES Control Panel

R 22-10-09 Flight Control Panel

R 22-10-11 AFCS/MLG Accessory Unit

R 22-10-12 Flight Control Auxiliary Unit

R 2. APFDS ENGAGE Panel

R A. Description

R The APFDS (autopilot flight director system) ENGAGE panel
R (Ref. Fig. 1) is used to engage the autopilots and flight
R directors. The panel contains two autopilot engage
R switches, two flight director switches and a turbulence mode
R switch. The front panel is internally edge-lighted. Two
R electrical connectors are provided on the rear of the panel.

R (1) Autopilot Engage Switches

TURBULENCE SWITCH
REDUCES PITCH AND ROLL GAINS TO 1/2, BUT DOES NOT CHANGE SAS. DISENGAGE AUTOTHROTTLE SYSTEM AND ALL MODES EXCEPT GO-AROUND AND AUTOLAND AFTER TRACKING HAS BEGUN. TRIPS AUTOPILOT TO CWS IF IN CMD. PROVIDES AUTOMATIC PITCH TRIM. DRIVES COMMAND BARS OUT OF VIEW. DISENGAGE BY PUSHING AGAIN OR BY DISENGAGING AP

AUTOPILOT SWITCH
EACH SOLENOID-HELD SWITCH CONTROLS ONE AUTOPILOT. CANNOT BE ENGAGED UNLESS ALL SIGNALS AND COMPUTER ARE VALID. ONLY ONE SWITCH MAY BE ENGAGED AT A TIME EXCEPT WHEN A/L MODE IS SELECTED

CWS
ENGAGES ONE AUTOPILOT AT A TIME IN THE CONTROL WHEEL STEERING MODE TO PROVIDE:
- PITCH HOLD UP TO 15°
- HEADING HOLD IF BANK IS 3° OR LESS
- BANK HOLD BETWEEN 3° AND 35° MAX. WILL RETURN TO 35° IF ENGAGEMENT BANK ANGLE IS GREATER THAN 35°. NO NAVIGATION MODES ARE AVAILABLE. ALTITUDE HOLD OR TURB MAY BE ENGAGED. AUTOPITCH TRIM IS OPERATIVE EXCEPT WHEN FORCE IS APPLIED TO CONTROL WHEEL AT WHICH TIME CONTROL WHEEL ELECTRIC TRIM IS OPERATIVE

CMD
SAME AS CWS IF NO MODES ENGAGED OR CAPTURED. EITHER OR BOTH AUTOPILOTS MAY BE ENGAGED, DEPENDING ON MODE SELECTION. ANY COMPATIBLE NAV AND HEADING/PITCH MODES MAY BE ENGAGED. AUTOPITCH TRIM OPERATIVE

OFF
AUTOPILOT IS SYNCHRONIZED WITH AIRCRAFT

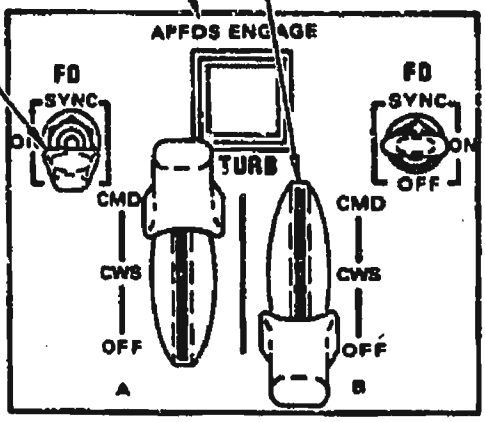
FLIGHT DIRECTOR SWITCH

OFF
ADI COMMAND BARS BIASED OUT OF VIEW

ON
ENGAGES FD SYSTEM. FD DISPLAY GIVEN ONLY ON ENGAGED SIDE
ANY APFDS MODE EXCEPT TURB MAY BE ENGAGED
BASIC ENGAGE FUNCTION (NO FLIGHT PATH SELECTED AND AUTOPILOT DISENGAGED) IS:
- PITCH HOLD
- HEADING HOLD IF BANK IS 3° OR LESS
- BANK HOLD IF BANK IS GREATER THAN 3°

SYNCHRONIZED PITCH AND ROLL AVAILABLE

SYNC
SYNCHRONIZES ADI COMMAND BARS TO EXISTING AIRCRAFT ATTITUDE WHEN AUTOPILOT IS OFF AND NO COMMAND MODES ARE SELECTED. WITH AN AUTOPILOT ENGAGED, COMMAND BARS ARE SYNCHRONIZED WITH THE AUTOPILOT



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APFDS ENGAGE Panel
Figure 1

The autopilot engage switches, identified as A and B, allow independent engagement of autopilots A and B, respectively. The two physically and functionally identical switches are three-position (OFF, CWS, and CMD), lever-operated wafer switches. The OFF position disengages the autopilot. The CWS position provides autopilot engagement in the basic configuration. The CMD position provides autopilot engagement in the command configuration.

The positioning of each autopilot engage switch in the CWS and CMD positions is electro-magnetically controlled by two individual holding solenoids. The switch cannot be engaged in the CWS or CMD position until the correct sequence logic is established in the autopilot computer that energizes the associated solenoid. After switch engagement, and depending on the logic provided by the autopilot, the switch may spring-return from CMD to CWS, from CMD to OFF, or from CWS to OFF. The switch can also be moved manually, to the OFF position overriding any holding solenoid. The logic-controlled holding solenoid operation ensures the following conditions:

(a) Avoidance of an autopilot engagement under faulty condition

(b) Automatic disengagement of an autopilot upon occurrence of a failure after engagement

(c) Automatic switching of an autopilot from the command configuration to the basic configuration (as required)

R (d) Avoidance of the two autopilots being engaged simultaneously except during the AUTOLAND mode

R (e) Avoidance of the two autopilots (during AUTOLAND mode) being engaged in an incompatible configuration, that is, engagement of one switch in the CWS position and the other switch in the CMD position

(2) Flight Director Switches

The flight director (FD) switches are three-position (OFF, ON, and SYNC) toggle switches with the SYNC position as a momentary contact. The two FD switches provide independent engagement of the two flight directors. The left switch controls the flight director A and the right switch controls the flight director B. With the FD switch in the OFF position,

R the associated flight director is disengaged. The ON
R position provides engagement of the associated flight
R director and allows the associated attitude director
R indicator to respond to the flight director command
R signals. The SYNC momentary position provides pitch
R and roll attitude synchronizations of the flight
R director to the desired pitch and roll attitude
R references. When either FD switch is placed in the
R SYNC position, both flight directors are synced
R simultaneously.

R (3) Turbulence Mode Switchlight

R The turbulence (TURB) mode switchlight initiates and
R annunciates mode engagement. This mode modifies the
R basic configuration or any selected command mode
R configuration to minimize the effects of turbulence.
R The switchlight is a push-to-engage/push-to-disengage
R switch and legend annunciating indicator. The switch
R controls the turbulence mode engage/disengage logic in
R both autopilots. The indicator contains four lamps.
R Two lamps provide low-level lighting (background
R lighting) and two lamps turn on the indicator upon mode
R engagement.

R B. Operation

R The engaging voltage controlled by the APFDS ENGAGE panel
R switching is 28V dc received from the aircraft dc bus
R directly or through the autopilot components.

R (1) Autopilot Engage Switch

R When the switch is in the OFF position (Ref. Fig. 2),
R the following conditions are provided in the associated
R autopilot:

R Pitch and roll autopilot servos disengaged

R Switch-off logic to autopilot

R Rudder servo engage hook solenoid valve
R deenergized

R Pitch autopilot servo engage solenoid valve
R deenergized.

R The following conditions are provided in the associated
R autopilot when the switch is moved towards CWS position
R and just prior to engagement in the CWS position:

R Excitation to switch holding solenoids and
R concurrent switch-on logic to autopilot

R Excitation to pitch servo modulation piston
R solenoid valve resulting in hydraulic power to
R modulation piston. CWS and CMD engage enable
R signals (ground) from autopilot to switch holding
R solenoids, enabling switch to advance and latch in
R CWS or CMD position

R Switch position logic transmitted to pitch
R computer for establishment of autopilot in basic
R (CWS) or command (CMD) configuration.

R When the switch is in the CWS position, the following
R conditions are provided in the autopilot:

R CWS engage logic to autopilot

R Excitation to pitch autopilot servo engage
R soleroid valve

R Excitation to left inboard aileron servo engage
R hook solenoid valve.

R When the switch is in the CMD positions, the following
R conditions are provided in the associated autopilot:

R CMD engage logic to pitch computer

R Excitation to pitch autopilot servo engage
R solenoid valve

R Excitation to left inboard aileron servo engage
R hook solenoid valve

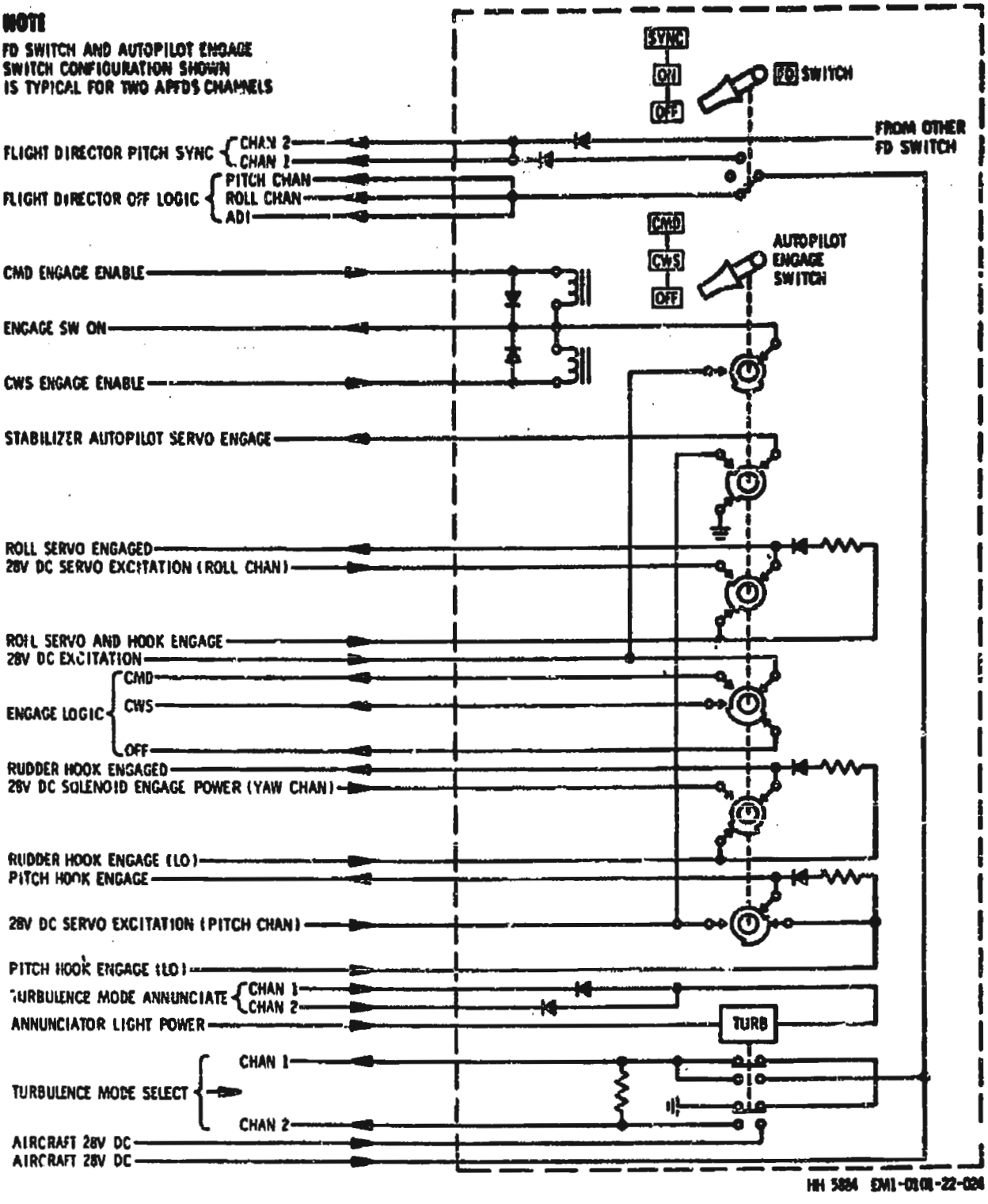
R Excitation to rudder servo engage hook solenoid
R valve.

R (2) Flight Director Switch

R With the FD switch in the OFF position, a 28V dc flight
R director inhibit signal is connected to the flight
R director.

R The ON position of the FD switch is an open contact.
R Placing the switch in the ON position removes the dc
R flight director inhibit signal that generated the
R flight director off logic.

R With the autopilot disengaged, initial flight director
R engagement results in pitch attitude hold and heading



R R APFDS ENGAGE Panel Simplified Schematic Diagram
Figure 2

R R EFFECTIVITY: ALL

hold or roll attitude hold command signal generation. New flight director pitch and roll attitude references may be established by flying to the desired pitch and roll attitudes and momentarily placing either FD switch in the SYNC position. The SYNC position connects the dc signal to both flight directors, causing them to synchronize to the new pitch and roll attitudes. The pitch SYNC switch function is disabled when the autopilot is engaged.

(3) Turbulence Mode Switchlight

When the turbulence (TURB) mode switchlight is momentarily depressed, the dc signal is connected to the autopilot channels to place them in the turbulence mode. The turbulence mode is disengaged, and the autopilot is returned to the basic configuration when the TURB switchlight is depressed the second time. When the turbulence mode is established, the autopilot channel logic circuits return a ground signal to light the switchlight.

3. NAV MODE Select Panel

A. Description and Operation

R The NAV MODE (navigation mode) select panel (Ref. Fig. 3) controls the navigation, localizer, approach, and AUTOLAND modes of the autopilot flight director system. The panel contains four mode selector switchlights, two course select control knobs with associated readout indicators, and a VOR system select switch. The front panel is internally edge-lighted. Two electrical connectors are provided on the rear of the panel. The functions of the controls are shown in Figure 4.

(1) Mode Selector Switchlights

The following mode selector switchlights are provided on the NAV MODE select panel:

R (a) A/L (AUTOLAND) switchlight to select and annunciate the AUTOLAND command mode. The mode is engaged for automatic localizer and glide slope capture, automatic flare, decrab and landing, and to maintain the preselected reference.

(b) APR (approach) switchlight to select and annunciate the ILS approach command mode. The mode is engaged for automatic localizer and glide

NAV MODE PANEL

Provides capability of coupling the autopilot/flight director system to selected radio navigation facilities for aircraft guidance, automatic approach, and landings. When pressed, the alternate action switches are illuminated to identify selected mode. Also, selected NAV mode is annunciated on both AFCS mode annunciator panels. Either autopilot must be engaged in CMD or at least one flight director must be on. Pressing the second time extinguishes light and disengages switch function (except A/L with autopilot in CMD after A/L track status is achieved).

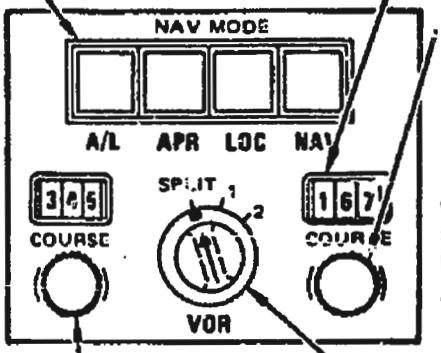
NAVIGATION MODE SELECT SWITCHES (4)

A/L - Arms APFDS for approach (FD only) or autoland (one or both autopilots engaged in CMD). LOC ARM, GS ARM, and A/L ARM appear in both AFCS mode annunciators.

APR - Arms APFDS for capture and tracking of localizer and glideslope. LOCK ARM AND GS ARM appear in both AFCS and annunciators. Does not provide autoland capability.

LOC - Arms APFDS for capture and tracking of localizer. Glideslope capture not available. LOC ARM appears in both AFCS annunciators. Not usable for back-course approaches.

NAV - Arms APFDS for VOR capture and tracking. VOR ARM appears in both AFCS annunciators. The switch also couples APFDS to the area navigation system if installed.



COURSE DISPLAY (2)

Indicates selected VOR course or ILS runway heading. Repeated on respective HSI course bar.

COURSE SELECTOR KNOB

Rotary selector knob that sets No. 2 VOR receiver to desired course. Positions course pointer on copilot's HSI. When set to ILS course, provides heading information to computer for wind integration, localizer capture, and runway alignment.

VOR SELECTOR SWITCH

Three-position rotary switch spring-loaded to the SPLIT position except when NAV is selected.

SPLIT - APFDS A receives signals from NAV 1 radio; APFDS B receives signals from NAV 2 radio.

1 - Both APFDSs receive signals from NAV 1 radio.

2 - Both APFDSs receive signals from NAV 2 radio.

The HSI is always referenced to individual receivers.

COURSE SELECTOR KNOB

Rotary selector knob that sets the No. 1 VOR receiver to desired course. Positions course pointer on captain's HSI. When set to ILS course, provides heading information to computer for wind integration, localizer capture, and runway alignment.

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R NAV MODE Select Panel
R Figure 3

R slope capture, and to maintain the preselected
R reference.

R (c) LOC (localizer) switchlight to select and
R annunciate the localizer mode. The localizer mode
R provides the capability to capture and maintain
R the selected localizer beam.

R (d) NAV (navigation) switchlight to select and
R annunicate the VOR navigation mode. The VOR mode
R provides the capability to capture and maintain
R the selected VOR navigation radial.

R Each mode selector switchlight is a
R push-to-engage/push-to-disengage switch and a mode
R annunciating indicator. When the desired switch is
R momentarily depressed, the mode command is given to the
R autopilot or flight director channels which results in
R engagement of that mode. Upon mode engagement, an
R annunciating signal is provided by the channel to light
R the switchlight. A mode is disengaged automatically
R when another mode is selected, or a mode can be
R disengaged manually by momentarily depressing the mode
R selector switchlight.

R (2) VOR System Select Switch

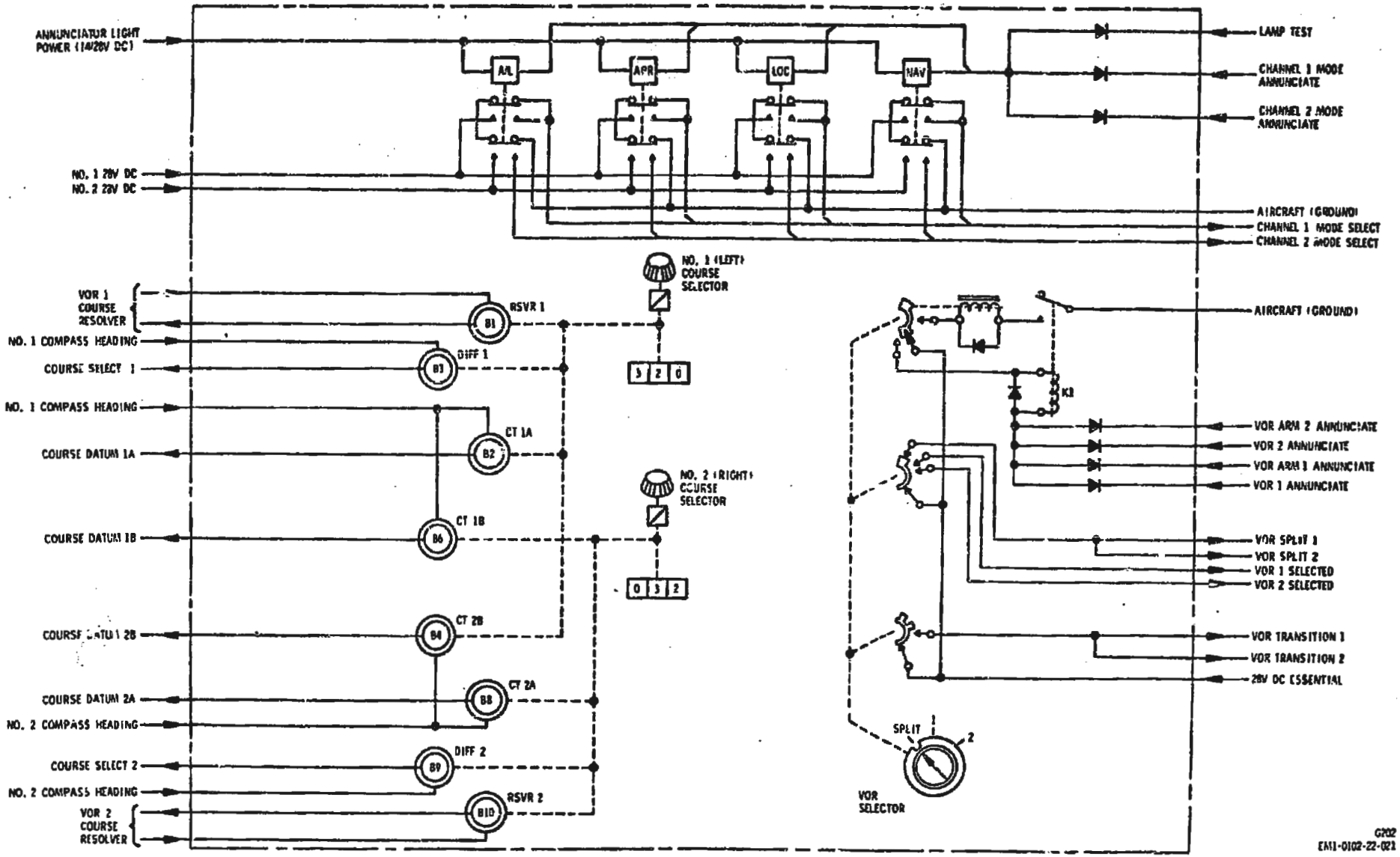
R The VOR system select switch has three positions: VOR
R SPLIT, 1, and 2. VOR positions 1 and 2 can only be
R selected in VOR mode. When switching out of the VOR
R mode, the switch automatically trips to SPLIT. The
R switch is used to control the VOR course tracking
R operation using the No. 1 or No. 2 VOR system or both
R systems individually. With the system selector switch
R placed in the VOR 1 position, the following conditions
R are established:

R (a) Left COURSE select knob controls course datum
R input to both autopilots and flight directors

R (b) VOR 1 select logic to both autopilots and flight
R directors

R (c) VOR deviation flag logic from VOR system No. 1 to
R both autopilots and flight directors

R With the system select switch placed in the VOR 2
R position, the conditions are similar to the VOR 1
R selection. The course selection is controlled by the
R right COURSE select knob only, and both autopilots and
R flight directors function with the No. 2 VOR system.



R NAV MODE Select Panel Simplified Schematic Diagram
R Figure 4

R EFFECTIVITY: ALL
R
050B

R The VOR SPLIT position establishes the usage of the
R individual COURSE select knobs for separate course
R selections (VOR 1, VOR 2) and the operation of
R autopilots and flight directors with the respective VOR
R system (VOR 1 and autopilot and flight director A, and
R VOR 2 and autopilot and flight director B).

R (3) Course Select Control

R Each of the two COURSE select knobs provides manual
R selection of the desired VOR navigation radial to be
R tracked by the autopilot flight director system
R (APFDS). The two VOR navigation systems can be
R controlled by the left or right COURSE select knob, or
R by the individual knobs, depending on the position of
R the VOR system select switch. Each COURSE select knob
R is mechanically connected to an associated readout
R indicator and a set of one differential, one resolver,
R and two control transformers. The knob is rotated
R until the desired course is read on the indicator. The
R knob rotation concurrently positions the differential,
R the resolver, and control transformers relative to the
R selected course.

R The differential compares the selected course with the
R compass magnetic heading input. The resultant course
R error is then applied to the horizontal situation
R indicator to position the course select pointer.

R The course select resolver, which is mechanically
R coupled to the COURSE select knob, determines the
R deviation of the actual VOR bearing with respect to the
R selected VOR course. The resolver is electrically
R coupled to a manual VOR resolver in the VOR system.
R The deviation is applied through the VOR system to the
R horizontal situation indicator. The course resolvers
R corresponding to the left and right COURSE selector
R knobs are connected to VOR systems No. 1 and No. 2
R respectively.

R The control transformers (two driven by each COURSE
R select knob) provide course data to the APFDS computers
R for VOR radial-capturing computation. Each control
R transformer determines the course datum error by
R comparing the manually selected course and the magnetic
R heading input from the compass coupler. The use of the
R control transformers is as follows:

R (a) When the VOR select switch is in the VOR 1
R position, the control transformers controlled by
R the left COURSE select knob are connected to the
R APFDS. The control transformers obtain inputs

R from the compass couplers and provide the
R resultant course datum errors to the APFDS.

R (b) When the VOR select switch is placed in the VOR 2
R position, the configuration is similar to the VOR
R 1 selection. However, only the control
R transformers controlled by the right COURSE select
R knob are connected to the APFDS.

R (c) With the VOR select switch in the VOR SPLIT
R position, the two autopilots and flight directors
R are controlled separately by the two COURSE select
R knobs. In VOR SPLIT, a control transformer
R controlled by each COURSE select knob is connected
R to its respective autopilot and flight director.

R 4. HEADING/PITCH MODE Panel

R A. Description and Operation

R The HEADING/PITCH MODE command panel (Ref. Fig. 5) controls
R the heading mode and the pitch axis modes of autopilot
R flight director system (APFDS) operations. Two electrical
R connectors are provided on the rear of the panel. The panel
R contains five mode selector switchlights and two selector
R control knobs with associated readout indicators. The
R functions of the controls are shown in Figure 6.

R (1) Mode Selector Switchlights

R The mode selector switchlights are used to engage and
R annunciate APFDS modes of operation. Engage commands
R for the following modes are selected on the
R HEADING/PITCH MODE command panel:

R (a) VS (vertical speed) hold

R (b) ALT (altitude) hold

R (c) IAS (indicated airspeed) hold

R (d) MACH (Mach) hold

R (e) HDG (heading) select

R Each mode selector switchlight is a
R push-to-engage/push-to-disengage switch and the mode
R annunciating indicator. When the desired mode switch
R is momentarily depressed, a signal is provided to the
R related computers where, if all mode interlocks have
R been satisfied, the mode is engaged. Upon mode

PITCH MODE SELECTOR SWITCHES (4)

Alternate action pushbutton switches.

Selection requires FD on and/or autopilot in CMD. Only one pitch mode may be engaged at a time. Any pitch mode may be used with the HDG or NAV mode. Cannot be engaged when in TURB mode. IAS mode is inhibited after selection of APR or A/L mode. ALT and VS will supersede the APR mode after glideslope capture, but are inhibited in the A/L mode after A/L is annunciated on AFCS Modes panel. Switches illuminate to show selected mode. Also, selected mode is annunciated on both pilots' AFCS mode annunciator panels. Disengaged by pressing again, by disengaging AP and FD, or by engaging an alternate mode.

VS - Holds vertical speed existing at time of engagement. After engagement, VS may be varied by rotating thumbwheel. ALT or VS may be used for GS capture.

ALT - Holds altitude existing at time of engagement. May be engaged at any vertical speed with either autopilot in CWS or CMD or at least one FD on. Also engages with autocapture by altitude select system.

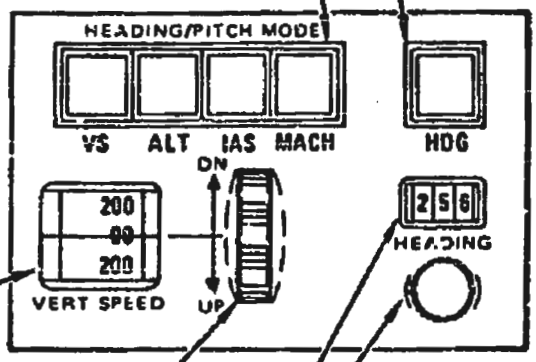
IAS - Holds indicated airspeed existing at time of engagement. Disengages ATS.

MACH - Holds Mach number existing at time of engagement. Disengages ATS.

HEADING MODE SELECTOR SWITCH

Alternate action pushbutton switch.

Pressing switch holds heading selected at time of engagement and provides heading reference for FD and/or autopilot in CMD. Will supersede LOC, NAV, or APR mode after LOC capture. Cannot be engaged in TURB mode. Disengages when pressed second time. Maximum bank angle is 28° at 200 knots, decreasing to 15° at 450 knots TAS.



VERTICAL SPEED DISPLAY

When VS mode is engaged, provides readout for selection of vertical speed. Synchronized to aircraft vertical speed when VS mode is not engaged.

VERTICAL SPEED CONTROL WHEEL

Rotary thumbwheel that provides control of the vertical speed reference for the APFDS when VS mode is selected. Inoperative in all other modes.

HEADING SELECT KNOB

Rotary knob that provides selection of APFDS heading reference. Positions heading bug on both HSI.

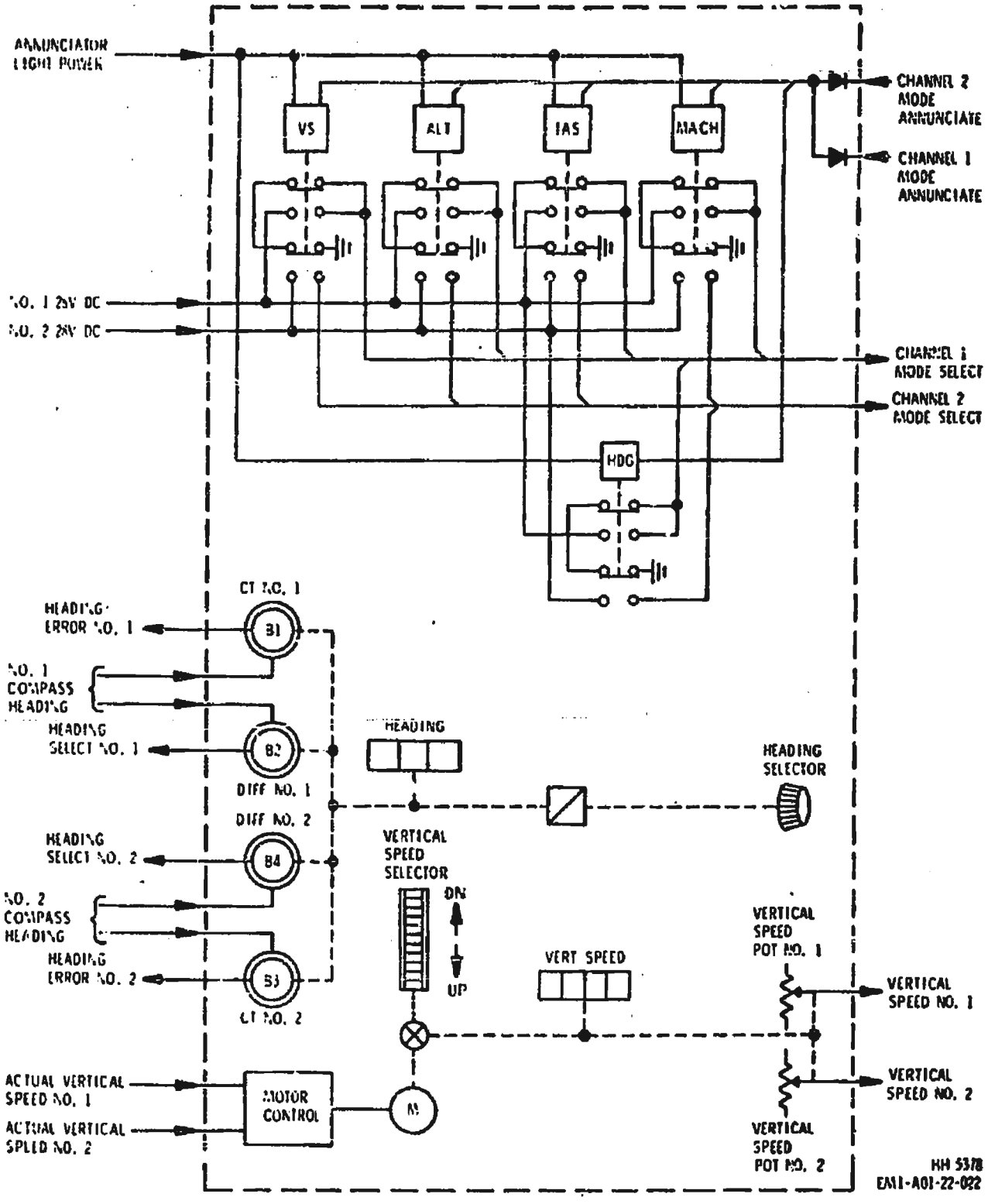
HEADING DISPLAY

Indicates selected heading which is the reference for APFDS.

M1-0101-22-375

R
R

HEADING/PITCH MODE Panel
Figure 5



R R HEADING/PITCH MODE Panel Simplified Schematic Diagram
Figure 6

R R EFFECTIVITY: ALL

0508

R engagement, an annunciating signal is provided by the
R computers to light the switchlight. The switchlight
R remains on as long as the mode is engaged. A mode is
R disengaged automatically when another mode which
R supersedes the existing mode is selected. The mode can
R also be disengaged manually by momentarily depressing a
R mode selector switchlight.

R (2) Heading Select Control

R The HEADING select control provides selection of a
R desired aircraft heading to be captured and flown by
R the APFDS. The control knob is mechanically connected
R to a readout indicator and to two sets of a
R differential and a control transformer. The control
R knob is rotated until the desired heading is read out
R on the indicator. The knob rotation concurrently
R positions the differentials and the control
R transformers relative to the selected heading.

R The two identical control transformers correspond to
R the two autopilots and flight directors (roll axis).
R Each resolver obtains aircraft magnetic heading
R information and derives the heading error. The heading
R error is used by the autopilot and flight director to
R determine the amount of roll required to achieve the
R selected heading.

R The two identical differentials function with the
R horizontal situation indicators. Each differential
R obtains the aircraft magnetic heading and compares it
R with the selected heading. The resultant heading error
R is transmitted to the horizontal situation indicator to
R position the heading select pointer.

R (3) Vertical Speed Select Control

R The vertical speed select control provides a desired
R vertical speed (climb or dive) during the vertical
R speed mode of operation. The control knob is
R mechanically connected to the VERT SPEED readout
R indicator and the arms of two potentiometers through a
R gearbox. The control knob is turned towards the DN
R (down) or UP position for descending or ascending
R vertical speed. The control knob is turned until the
R desired speed is indicated on the readout indicator.
R The control is capable of selecting a vertical speed up
R to 4000 feet per minute in both ascent and descent.

R The two potentiometers correspond to the two autopilots
R and flight directors. As the control knob is rotated
R to select a vertical speed, each potentiometer arm is

R positioned to provide a voltage signal equivalent to
R the selected vertical speed. The signal is applied to
R the corresponding autopilot and flight director where
R the correction is made to achieve the selected vertical
R speed.

R (4) Vertical Speed Readout Indicator

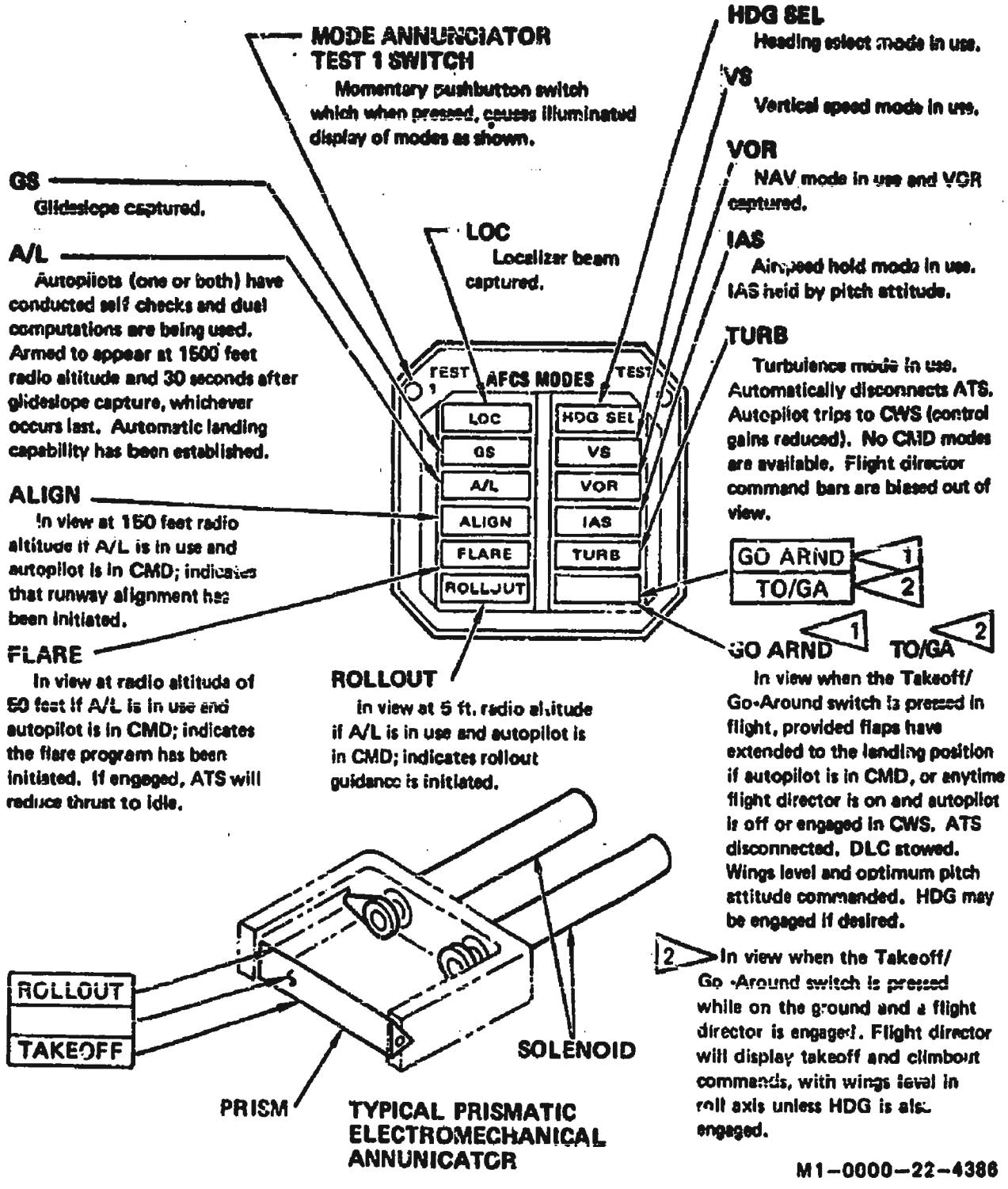
R During the vertical speed hold mode of operation, the
R vertical speed (VERT SPEED) readout indicator displays
R a selected vertical speed. Otherwise, the indicator is
R in constant synchronism with the actual aircraft
R vertical speed. The indicator is capable of displaying
R between ascent rate of 4000 feet per minute and descent
R rate of 8000 feet per minute. The readout is shaded
R with two different colors to distinguish between
R ascending and descending conditions. The readout is
R provided with two slope changes in the scale factor
R over the full range. The readout tape is marked in
R graduations of 200 feet per minute in 0 to 1000 feet
R per minute range for both ascent and descent; and 500
R feet per minute for ascending rates of 1000 to 4000
R feet per minute and descending rates of 8000 to 1000
R feet per minute.

R 5. AFCS MODES Annunciator

R A. Description and Operation

R The AFCS MODES annunciator (Ref. Fig. 7) displays the flight
R modes in use by the auto flight system. The indicator
R consists of two columns of six annunciators and two test
R switches.

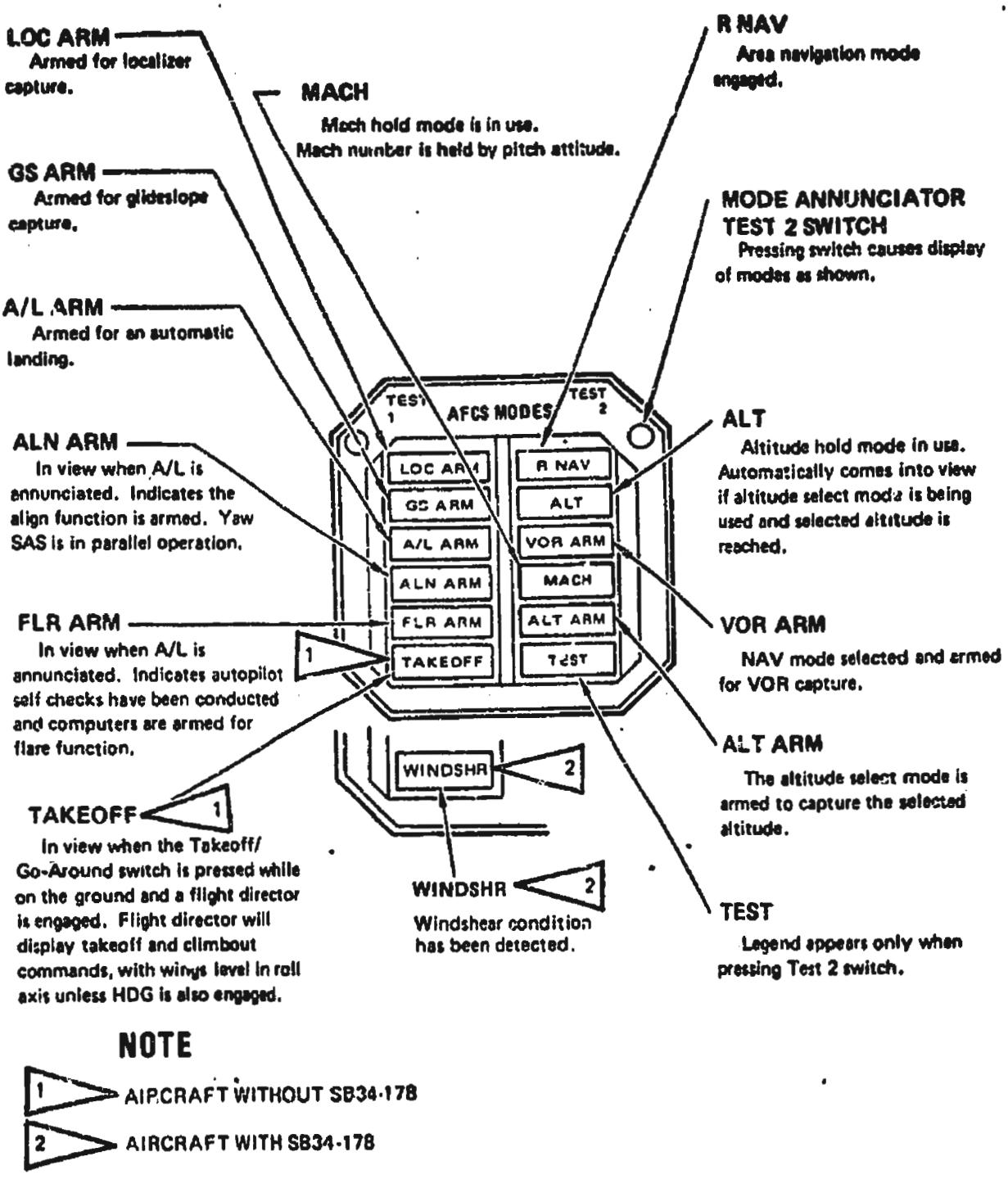
R Each of the 12 annunciators is a prismatic,
R electro-mechanical device which allows 3 annunciator legends
R to be displayed. The device consists of a three-faced prism
R and two prism-driving solenoids. Each face of the prism is
R available for an annunciator legend; however, for AFCS
R flight mode usage, only two faces are used. The third face
R is blank and is in the display position when deactivated.
R The prism is electro-mechanically rotatable in either
R direction about the longitudinal axis so that one of the
R other faces (upper and lower) can appear in the display
R position. A solenoid actuated by a remote mode signal (dc
R ground) drives the prism mechanism. The prism is driven 120
R degrees in the required direction to display the
R corresponding mode legend in the display position. When the
R solenoid loses the signal, the prism reverts to the original
R position (display of the blank face). The second solenoid


MODE ANNUNCIATOR TEST 1 SWITCH
Momentary pushbutton switch which when pressed, causes illuminated display of modes as shown.
HDG SEL
Heading select mode in use.
VS
Vertical speed mode in use.
VOR
NAV mode in use and VOR captured.
IAS
Airspeed hold mode in use. IAS held by pitch attitude.
TURB
Turbulence mode in use. Automatically disconnects ATS. Autopilot trips to CWS (control gains reduced). No CMD modes are available. Flight director command bars are biased out of view.
GS
Glideslope captured.
LOC
Localizer beam captured.
A/L
Autopilots (one or both) have conducted self checks and dual computations are being used. Armed to appear at 1500 feet radio altitude and 30 seconds after glideslope capture, whichever occurs last. Automatic landing capability has been established.
TEST 1
AFCS MODES
TEST 2
LOC
GS
A/L
ALIGN
FLARE
ROLLOUT
HDG SEL
VS
VOR
IAS
TURB
ALIGN
In view at 150 feet radio altitude if A/L is in use and autopilot is in CMD; indicates that runway alignment has been initiated.
GO ARND
TO/GA
1
2
FLARE
In view at radio altitude of 50 feet if A/L is in use and autopilot is in CMD; indicates the flare program has been initiated. If engaged, ATS will reduce thrust to idle.
ROLLOUT
In view at 5 ft. radio altitude if A/L is in use and autopilot is in CMD; indicates rollout guidance is initiated.
GO ARND 1
TO/GA 2
In view when the Takeoff/ Go-Around switch is pressed in flight, provided flaps have extended to the landing position if autopilot is in CMD, or anytime flight director is on and autopilot is off or engaged in CWS. ATS disconnected. DLC stowed. Wings level and optimum pitch attitude commanded. HDG may be engaged if desired.
2
In view when the Takeoff/ Go-Around switch is pressed while on the ground and a flight director is engaged. Flight director will display takeoff and climbout commands, with wings level in roll axis unless HDG is also engaged.
ROLLOUT
TAKEOFF
SOLENOID
PRISM
TYPICAL PRISMATIC ELECTROMECHANICAL ANNUNICATOR
M1-0000-22-4386

R R AFCS MODES Annunciator
Figure 7 (Sheet 1)

EFFECTIVITY: ALL

001B


LOC ARM
Armed for localizer capture.
MACH
Mach hold mode is in use. Mach number is held by pitch attitude.
R NAV
Area navigation mode engaged.
GS ARM
Armed for glideslope capture.
MODE ANNUNCIATOR TEST 2 SWITCH
Pressing switch causes display of modes as shown.
A/L ARM
Armed for automatic landing.
TEST 1
AFCS MODES
TEST 2
LOC ARM
R NAV
GS ARM
ALT
A/L ARM
VOR ARM
ALN ARM
MACH
FLR ARM
ALT ARM
TAKEOFF
TEST
WINDSHR
ALN ARM
In view when A/L is annunciated. Indicates the align function is armed. Yaw SAS is in parallel operation.
ALT
Altitude hold mode in use. Automatically comes into view if altitude select mode is being used and selected altitude is reached.
FLR ARM
In view when A/L is annunciated. Indicates autopilot self checks have been conducted and computers are armed for flare function.
VOR ARM
NAV mode selected and armed for VOR capture.
ALT ARM
The altitude select mode is armed to capture the selected altitude.
TAKEOFF
In view when the Takeoff/ Go-Around switch is pressed while on the ground and a flight director is engaged. Flight director will display takeoff and climbout commands, with wings level in roll axis unless HDG is also engaged.
WINDSHR
Windshear condition has been detected.
TEST
Legend appears only when pressing Test 2 switch.
NOTE
1 AIRCRAFT WITHOUT SB34-178
2 AIRCRAFT WITH SB34-178

M1-0000-22-4389

R AFCS MODES Annunciator
R Figure 7 (Sheet 2)

EFFECTIVITY: ALL

001B

is used with another mode and drives the prism in the opposite direction.

As the various flight modes are enabled, dc ground circuits are established for the corresponding annunciator devices to drive the legends into view. The displayable mode legends are shown in Figure 7.

The AFCS MODES annunciator contains a self-test feature to test the operation of the annunciator electro-mechanisms. Two pushbutton switches, TEST 1 and TEST 2, are provided to perform the test. The TEST 1 switch is used (Ref. Fig. 7, Sheet 1) to check the upper prism face electro-mechanisms. When the switch is depressed, a dc ground is applied to all solenoids corresponding to the upper prism faces. All the upper face legends appear simultaneously in the display position if the related circuits and mechanisms are functioning properly. Similarly, the TEST 2 switch is used (Ref. Fig. 7, Sheet 2) to test the lower prism face electro-mechanisms. In this case, the entire set of lower face legends appear simultaneously in the display position.

6. AFCS WARNING Indicator

A. Description and Operation

The AFCS WARNING indicator (Ref. Fig. 8) displays those warnings critical to auto flight operation that require immediate pilot action. The indicator consists of four annunciators, an ALERT pushbutton switch indicator, and two self-test switches. The AFCS WARNING indicator displays the following:

(1) Autopilot disengagement warning (AP DISC)

(2) Degradation of AUTOLAND mode status (normally fail-operational) to a fail-passive status (NO DUAL)

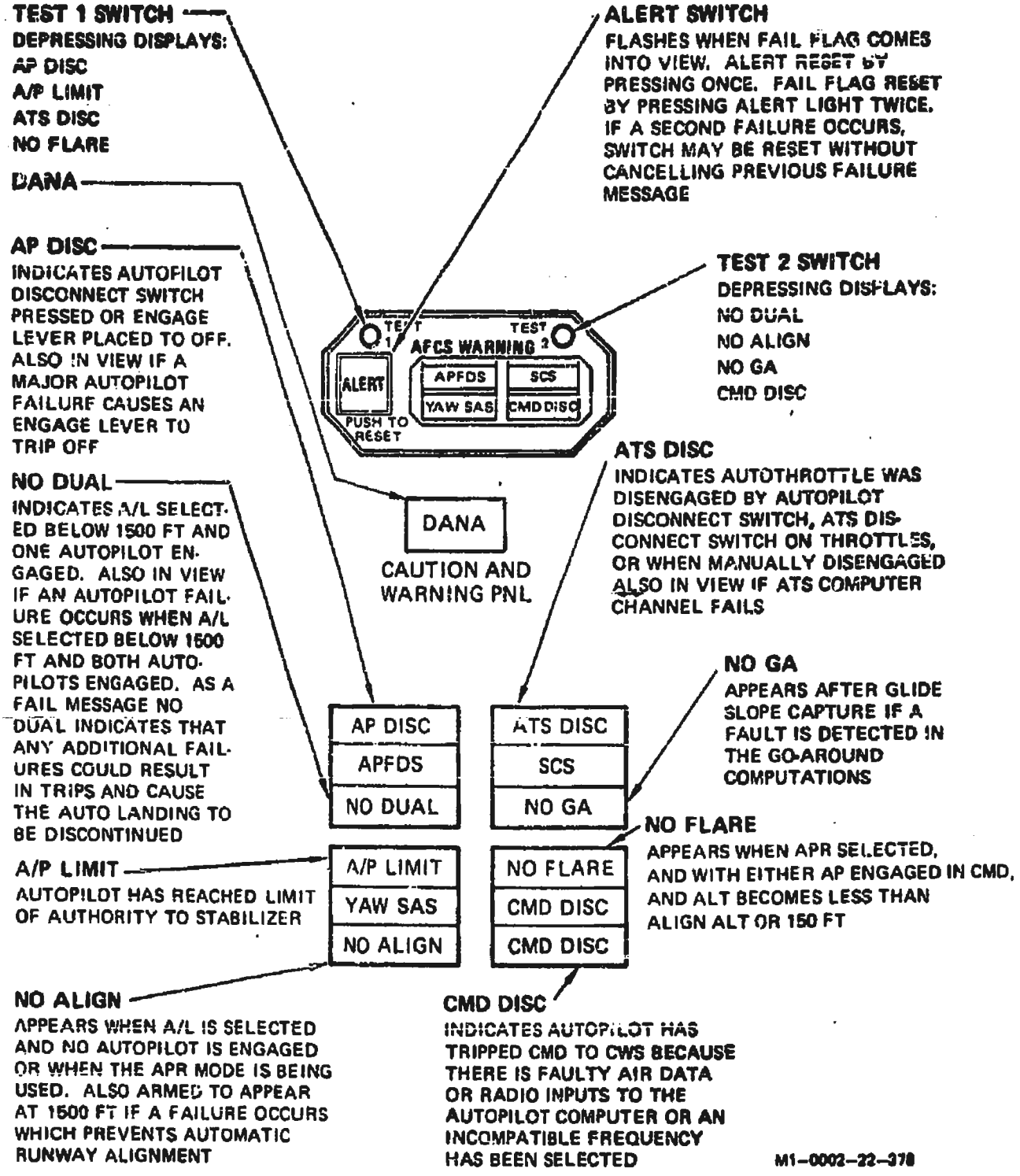
(3) Pitch autopilot limit warning (A/P LIMIT)

(4) Runway alignment mode failure warning (NO ALIGN)

(5) Autothrottle system disengagement warning (ATS DISC)

(6) Go-around mode failure warning (NO GA)

R (7) No flare condition when in approach (APR) modes, and
R with either autopilot engaged in command mode, and when
R the altitude becomes less than align altitude or 150
R feet (NO FLARE)


TEST 1 SWITCH
DEPRESSING DISPLAYS:
AP DISC
A/P LIMIT
ATS DISC
NO FLARE
DANA
AP DISC
INDICATES AUTOPILOT DISCONNECT SWITCH PRESSED OR ENGAGE LEVER PLACED TO OFF. ALSO IN VIEW IF A MAJOR AUTOPILOT FAILURE CAUSES AN ENGAGE LEVER TO TRIP OFF
NO DUAL
INDICATES A/L SELECTED BELOW 1500 FT AND ONE AUTOPILOT ENGAGED. ALSO IN VIEW IF AN AUTOPILOT FAILURE OCCURS WHEN A/L SELECTED BELOW 1500 FT AND BOTH AUTOPILOTS ENGAGED. AS A FAIL MESSAGE NO DUAL INDICATES THAT ANY ADDITIONAL FAILURES COULD RESULT IN TRIPS AND CAUSE THE AUTO LANDING TO BE DISCONTINUED
A/P LIMIT
AUTOPILOT HAS REACHED LIMIT OF AUTHORITY TO STABILIZER
NO ALIGN
APPEARS WHEN A/L IS SELECTED AND NO AUTOPILOT IS ENGAGED OR WHEN THE APR MODE IS BEING USED. ALSO ARMED TO APPEAR AT 1500 FT IF A FAILURE OCCURS WHICH PREVENTS AUTOMATIC RUNWAY ALIGNMENT
ALERT SWITCH
FLASHES WHEN FAIL FLAG COMES INTO VIEW. ALERT RESET BY PRESSING ONCE. FAIL FLAG RESET BY PRESSING ALERT LIGHT TWICE. IF A SECOND FAILURE OCCURS, SWITCH MAY BE RESET WITHOUT CANCELLING PREVIOUS FAILURE MESSAGE
TEST 2 SWITCH
DEPRESSING DISPLAYS:
NO DUAL
NO ALIGN
NO GA
CMD DISC
TEST 1
TEST 2
AFCS WARNING
ALERT
PUSH TO RESET
APFDS
SCS
YAW SAS
CMD DISC
DANA
CAUTION AND WARNING PNL
ATS DISC
INDICATES AUTOTHROTTLE WAS DISENGAGED BY AUTOPILOT DISCONNECT SWITCH, ATS DISCONNECT SWITCH ON THROTTLES, OR WHEN MANUALLY DISENGAGED ALSO IN VIEW IF ATS COMPUTER CHANNEL FAILS
NO GA
APPEARS AFTER GLIDE SLOPE CAPTURE IF A FAULT IS DETECTED IN THE GO-AROUND COMPUTATIONS
NO FLARE
APPEARS WHEN APR SELECTED, AND WITH EITHER AP ENGAGED IN CMD, AND ALT BECOMES LESS THAN ALIGN ALT OR 150 FT
AP DISC
APFDS
NO DUAL
A/P LIMIT
YAW SAS
NO ALIGN
ATS DISC
SCS
NO GA
NO FLARE
CMD DISC
CMD DISC
CMD DISC
INDICATES AUTOPILOT HAS TRIPPED CMD TO CWS BECAUSE THERE IS FAULTY AIR DATA OR RADIO INPUTS TO THE AUTOPILOT COMPUTER OR AN INCOMPATIBLE FREQUENCY HAS BEEN SELECTED
M1-0002-22-378

R AFCS WARNING Indicator
R Figure 8

EFFECTIVITY: ALL

001B

(8) Command configuration disconnect warning (CMD DISC)

Each of the four annunciators is a prismatic electro-mechanical device which allows three annunciator legends to be displayed. The device consists of a three-faced prism and two prism-driving solenoids. Each face of the prism is available for an annunciator legend. A prism face bearing the system name is normally in the display position. The prism is electro-mechanically rotatable in either direction about the longitudinal axis to display the other two faces (upper and lower) bearing the warning legends. A solenoid, when actuated by a remote warning signal (dc ground), drives the prism mechanism. The prism is rotated 120 degrees in the direction to display the corresponding prism face into the display position. When the solenoid loses the signal, the prism reverts to the original position. The second solenoid, when actuated, drives the prism 120 degrees in the opposite direction.

If two warnings appear in a system, the warning corresponding to the upper prism face takes precedence. For example, if the autopilot disengagement occurs when the autopilot is in the NO DUAL operation, the AP DISC warning overrides the NO DUAL warning and appears in the display position.

The appearance of any warning indication is simultaneously accompanied by the flashing ALERT switchlight to attract the pilots attention. The flashing continues until the alert is acknowledged by a momentary depression of the switchlight or acknowledgement through external control. The warning can be removed by depressing the ALERT switchlight the second time.

The AFCS WARNING indicator contains a self-test feature to test the operation of the annunciator electro-mechanisms and the alert circuits. Two pushbutton switches, TEST 1 and TEST 2, are provided to perform the self-test. The TEST 1 switch is used to check the electro-mechanisms and alert circuits corresponding to the upper prism faces. When the switch is held depressed, all the upper prism faces appear simultaneously in the display positions and the ALERT switchlight flashes. When the TEST 1 switch is depressed, the DANA light in the caution and warning panel will also come on. Similarly, the TEST 2 switch is used to test the electro-mechanism and alert circuits corresponding to the lower prism faces. In this case, the lower prism faces are displayed and the ALERT switchlight flashes. The two test switches are used together for the warning priority override test in which the ability of the upper prism face warnings to override the lower prism face warnings is checked. Together with the two test switches, the ALERT switchlight

is used to test the alert flasher circuit. The entire test requires that power be applied to the warning indicator.

R (9) Dual Autoland Not Available (DANA)

R Failures within the AFCS and associated sensing
R and servo systems which can be detected by
R existing failure monitoring within the APFDS and
R which would prohibit engagement of the system in
R the fail-operational approach/land configuration
R will cause a "Dual Autoland Not Available" signal
R to be generated for transmission to a DANA
R annunciator light on the pilots caution and
R warning panel. Generation of this signal is
R independent of APFDS configuration and modes of
R operation, except during the fail-operational
R approach/land track mode, when generation of the
R signal is inhibited until the recall logic is
R satisfied. A reset switch is provided on the
R caution and warning panel to permit the failure
R warning annunciation to be turned off. Dropout of
R the DANA signal from the AFCS for a period of 500
R milliseconds or longer will re-arm the failure
R warning annunciation function.

7. AFCS/MLG Accessory Unit

A. Description and Operation

The AFCS/MLG (avionics flight control system/main landing gear) accessory unit is located on the FCES center rack (Ref. Fig. 9). The unit is housed in a 1/4 ATR case. The unit front panel consists of a rack mounting lug and a carrying handle. A dual electrical connector is provided on the rear of the unit for system interface. The unit contains a chassis on which the relays, diodes, and terminal board are mounted.

A simplified schematic of the AFCS/MLG accessory unit and its interfacing systems is shown in Figure 10. The unit provides the auto flight system with three types of signals:

- Weight on Wheels (Air/Ground)
- Truck Level/Tilt
- Landing Gear Handle Position

(1) Weight on Wheels (Air/Ground) Signal

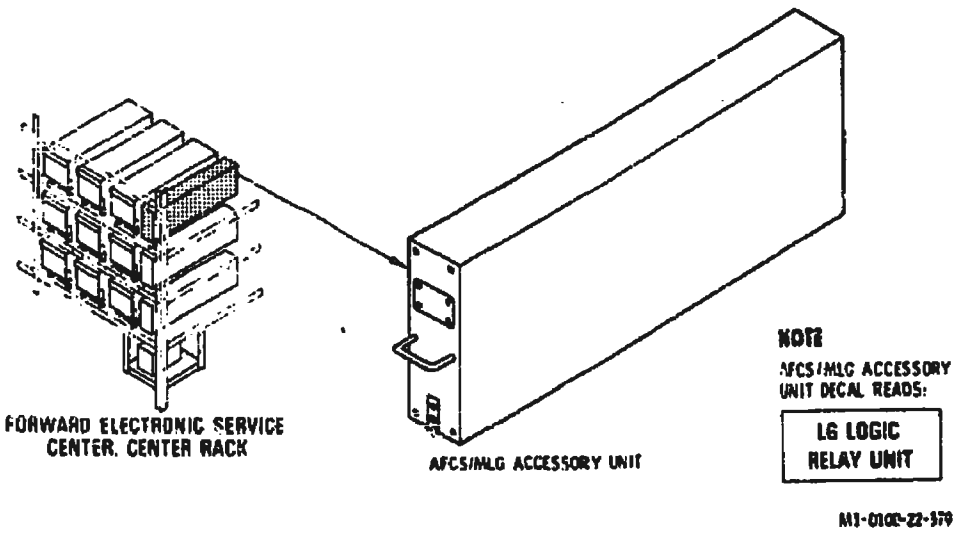
A ground IN-AIR or 28V dc ON-GROUND signal is provided by relays K1, K2, K3 and K4. Relays K1 and K2 are energized by weight on the L MLG. Relays K3 and K4 are energized by weight on the R MLG.

(2) Truck Level/Tilt Signal

A ground TRUCK LEVEL or 28V dc TRUCK TILT signal is provided by latching relays K5, K6, K9 and K11. Relays K5 and K11 are latched to TILT position when L MLG truck is tilted. Relays K6 and K9 are latched when R MLG truck is tilted. Setting flaps to less than 30 degrees or setting 2 of 3 throttle levers to greater than TAKEOFF/GO-AROUND position resets latching relays K5, K6, K9 and K11.

(3) Landing Gear Handle Position

A 28V dc UP or DOWN landing gear handle signal is provided by relays K10 and K12. Relays K10 and K12 are energized by the landing gear handle in the NEUTRAL or UP positions.



AFCS/MLG Accessory Unit
Figure 9

8. FCES Control Panel

A. Description

The FCES (flight control electronics system) control panel (Ref. Fig. 11) contains switchlights to provide failure monitoring and engage/disengage controls for the systems and functions of the auto flight system. A momentary pushbutton switch is also provided on the panel for self-test purposes. Two electrical connectors are provided on the rear of the panel. The front panel is internally edge-lighted.

The panel provides the following functions:

(1) Failure monitoring and disengagement of the failure-affected channel of the following systems and functions:

(a) Pitch trim

(b) Mach trim

(c) Auto throttle system (ATS)

(d) Stall warning

(e) Direct lift control (DLC/AUTO-SPLR)

(f) Yaw system (YAW SAS)

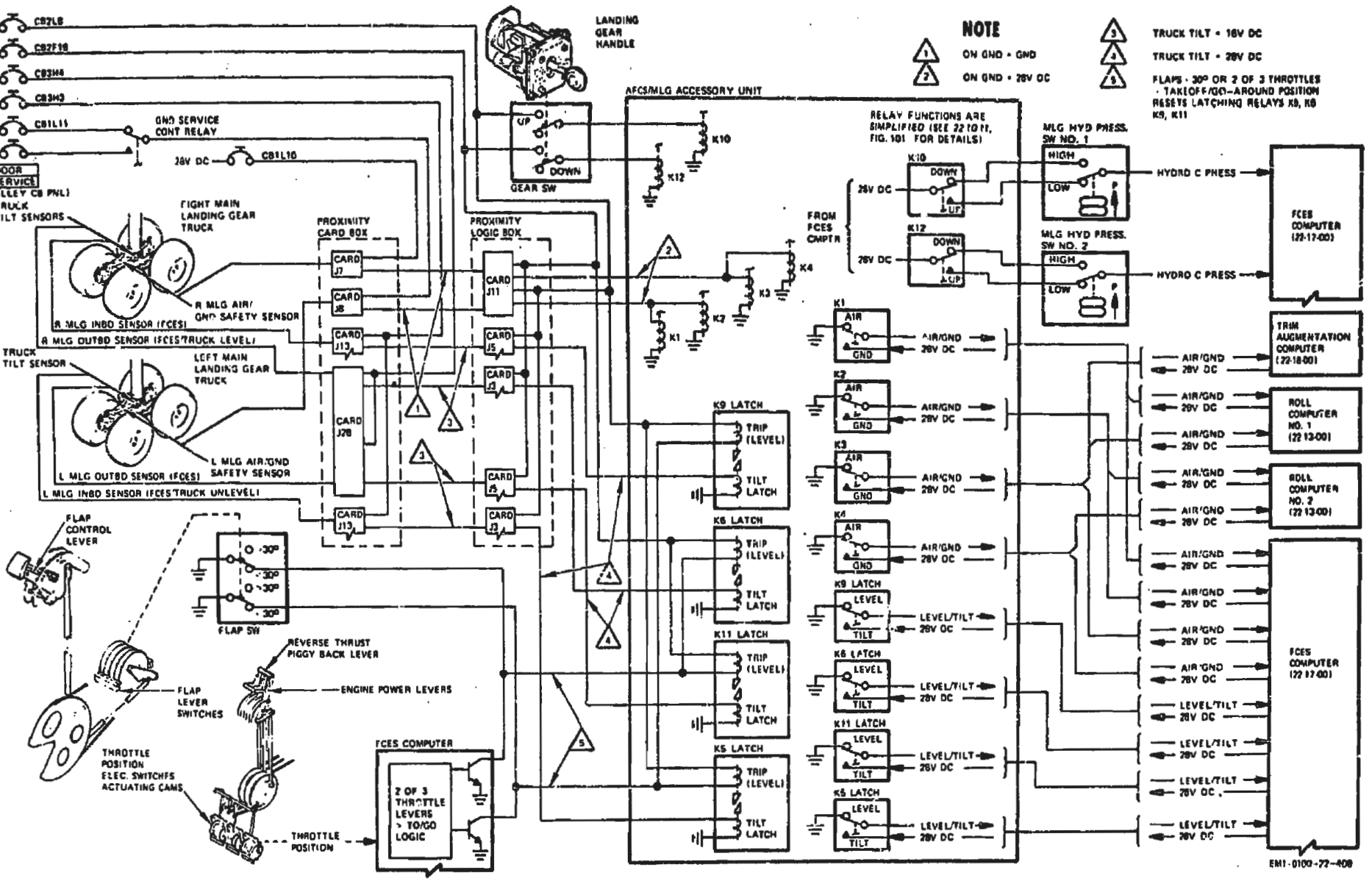
(2) Selective engagement and disengagement of the above systems and functions under normal condition.

(3) Preflight testing capability of the stall warning function in a single channel or both channels simultaneously.

B. Operation

The switchlights are push-to-engage/push-to-disengage switches which display OFF-FAIL legends. Each switchlight is normally in the depressed (latched in) position. The switchlight is released (out) by depressing it again.

When a channel controlled by the FCES control panel is operating normally, the switchlight assigned to the channel appears dark (OFF-FAIL legends not visible). When a failure is detected in a channel, the FAIL legend of the corresponding switchlight comes on. By momentarily depressing the switchlight, the FAIL legend goes out and the OFF legend comes on to indicate that the channel is off.


NOTE
1 ON GND = GND
2 ON GND = 28V DC
3 TRUCK TILT = 16V DC
4 TRUCK TILT = 28V DC
5 FLAPS - 30° OR 2 OF 3 THROTTLES - TAKEOFF/GO-AROUND POSITION RESETS LATCHING RELAYS K9, K11
LANDING GEAR HANDLE
GEAR SW
GND SERVICE CONT RELAY
MLG DOOR GND SERVICE (LH GALLEY CB PNL)
TRUCK TILT SENSORS
RIGHT MAIN LANDING GEAR TRUCK
R MLG AIR/GND SAFETY SENSOR
R MLG INBD SENSOR (FCES)
R MLG OUTBD SENSOR (FCES/TRUCK LEVEL)
TRUCK TILT SENSOR
LEFT MAIN LANDING GEAR TRUCK
L MLG AIR/GND SAFETY SENSOR
L MLG OUTBD SENSOR (FCES)
L MLG INBD SENSOR (FCES/TRUCK UNLEVEL)
PROXIMITY CARD BOX
PROXIMITY LOGIC BOX
AFCS/MLG ACCESSORY UNIT
RELAY FUNCTIONS ARE SIMPLIFIED (SEE 22 10 11, FIG. 101 FOR DETAILS)
FROM FCES CMPTR
K9 LATCH
K6 LATCH
K11 LATCH
K5 LATCH
TRIP (LEVEL)
TILT LATCH
MLG HYD PRESS. SW NO. 1
MLG HYD PRESS. SW NO. 2
HYDRO C PRESS
FCES COMPUTER (22-17-00)
TRIM AUGMENTATION COMPUTER (22-18-00)
ROLL COMPUTER NO. 1 (22-13-00)
ROLL COMPUTER NO. 2 (22-13-00)
AIR/GND
LEVEL/TILT
28V DC
FLAP CONTROL LEVER
FLAP SW
FLAP LEVER SWITCHES
REVERSE THRUST PIGGY BACK LEVER
ENGINE POWER LEVERS
THROTTLE POSITION ELEC. SWITCHES ACTUATING CAMS
THROTTLE POSITION
2 OF 3 THROTTLE LEVERS > TO/GO LOGIC
EM1-0100-22-400

AFCS/MLG Accessory Unit Simplified Schematic and Interface Diagram
Figure 10

EFFECTIVITY: ALL

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FCES CONTROL PANEL

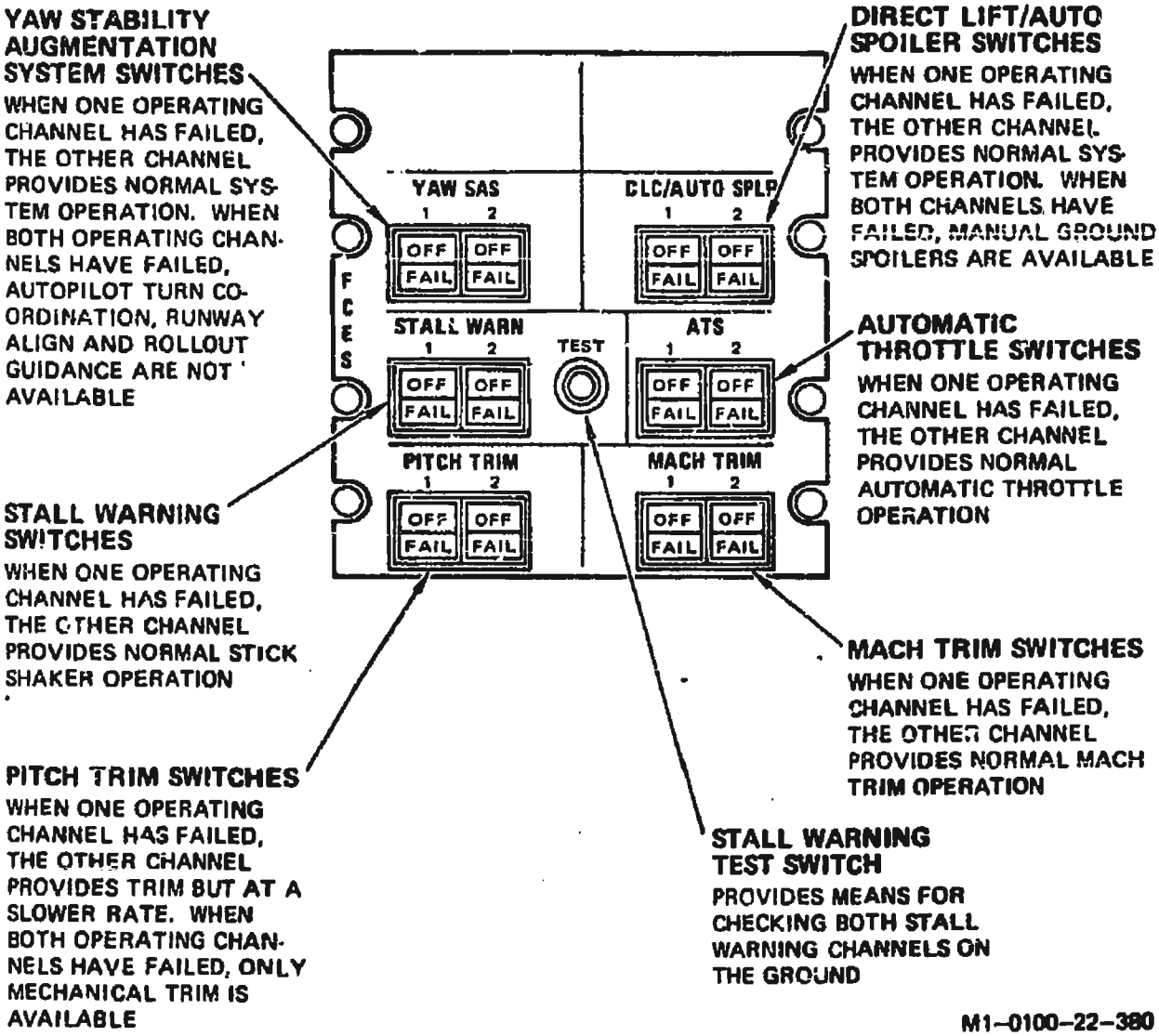
EACH FLIGHT CONTROL SYSTEM HAS TWO INDEPENDENT CHANNELS OF MONITORED OPERATION. A FAULT CAUSES AUTOMATIC CHANNEL SHUTDOWN. CERTAIN FAULTS IN ONE CHANNEL MAY SHUT DOWN BOTH CHANNELS

CHANNEL SWITCHLIGHT IN

NO LEGEND IS ILLUMINATED AND SYSTEM IS IN NORMAL OPERATION. FAIL LIGHT ARMED. WHEN FAIL IS ILLUMINATED, THE SYSTEM MONITOR HAS DETECTED A FAULT AND AUTOMATICALLY DEACTIVATED THE FAULTY CHANNEL.

CHANNEL SWITCHLIGHT OUT

THE CHANNEL IS DEACTIVATED AND THE FAIL LIGHT IS NOT ARMED. OFF IS ILLUMINATED TO SHOW SWITCH POSITION


YAW STABILITY AUGMENTATION SYSTEM SWITCHES
WHEN ONE OPERATING CHANNEL HAS FAILED, THE OTHER CHANNEL PROVIDES NORMAL SYSTEM OPERATION. WHEN BOTH OPERATING CHANNELS HAVE FAILED, AUTOPILOT TURN COORDINATION, RUNWAY ALIGN AND ROLLOUT GUIDANCE ARE NOT AVAILABLE
STALL WARNING SWITCHES
WHEN ONE OPERATING CHANNEL HAS FAILED, THE OTHER CHANNEL PROVIDES NORMAL STICK SHAKER OPERATION
PITCH TRIM SWITCHES
WHEN ONE OPERATING CHANNEL HAS FAILED, THE OTHER CHANNEL PROVIDES TRIM BUT AT A SLOWER RATE. WHEN BOTH OPERATING CHANNELS HAVE FAILED, ONLY MECHANICAL TRIM IS AVAILABLE
DIRECT LIFT/AUTO SPOILER SWITCHES
WHEN ONE OPERATING CHANNEL HAS FAILED, THE OTHER CHANNEL PROVIDES NORMAL SYSTEM OPERATION. WHEN BOTH CHANNELS HAVE FAILED, MANUAL GROUND SPOILERS ARE AVAILABLE
AUTOMATIC THROTTLE SWITCHES
WHEN ONE OPERATING CHANNEL HAS FAILED, THE OTHER CHANNEL PROVIDES NORMAL AUTOMATIC THROTTLE OPERATION
MACH TRIM SWITCHES
WHEN ONE OPERATING CHANNEL HAS FAILED, THE OTHER CHANNEL PROVIDES NORMAL MACH TRIM OPERATION
STALL WARNING TEST SWITCH
PROVIDES MEANS FOR CHECKING BOTH STALL WARNING CHANNELS ON THE GROUND
FCES
YAW SAS
CLC/AUTO SPLR
STALL WARN
ATS
PITCH TRIM
MACH TRIM
TEST
1 2
OFF FAIL
M1-0100-22-380

FCES Control Panel
Figure 11

The OFF legend also comes on when a selective disengagement of the channel is performed under normal conditions.

9. Flight Control Panel

A. Description

The flight control panel (Ref. Fig. 12) is used to monitor and control the MACH feel, the rudder mechanical limiter (on aircraft 001-017), and the rudder hydraulic limiter operations. The panel is located in the pilots overhead panel. The panel contains an indicator (meter) and switchlights. An electrical connector is provided on the rear of the panel for system interface. The panel is divided into the following two functional sections:

(1) MACH FEEL section containing the MACH indicator and two switchlights.

(2) On aircraft 001-017,
RUDDER LIMITER section containing two switchlights to monitor and control the mechanical limiter, and one switchlight to monitor and control the hydraulic limiter.

R (2) On aircraft 018-999,
RUDDER LIMITER section containing one switchlight to monitor and control the hydraulic limiter.

B. Operation

(1) Mach Feel Control

Switchlights 1 and 2 in the MACH FEEL section provide failure-monitoring, turn-on, and turn-off of the dual-channel Mach feel control system. The switchlights are normally depressed (latched in), and are dark (out) when the Mach feel system is operating. A fault in the system results in automatic disengagement of the system channel(s), and the FAIL legend on the switchlight(s) comes on. If the failure is detected by the system channel in-line monitor, only the affected channel is automatically disengaged, and the FAIL legend on the associated switchlight comes on; the other channel remains operational. If the failure is detected by the system comparison monitor, both channels are automatically disengaged, and the FAIL legend of each switchlight comes on. The failed channel is turned off by releasing (out) the affected switchlight, which causes the FAIL legend to go off and the OFF legend to come on.

RUDDER AUTO/MANUAL MECHANICAL LIMITER SWITCH

INDICATES RUDDER LIMITING SYSTEM STATUS AND PERMITS CONTROLLING MECHANICAL LIMITER IF SYSTEM MALFUNCTIONS

IN

NORMAL POSITION. NO LIGHTS ILLUMINATED. PUSH SWITCH LEGEND, AND RUDDER MECH LMTR AND FLT CONT PANELS ON THE MASTER ANNUNCIATOR PANEL ARE ILLUMINATED WHEN MECHANICAL LIMITER IS NOT IN CORRECT POSITION FOR EXISTING FLIGHT CONDITION

OUT

PUSH IS EXTINGUISHED AND MNL IS ILLUMINATED TO INDICATE THE AUTOMATIC MECHANICAL LIMITING FEATURE IS DEACTIVATED. ALSO, THE 8°/30° FEATURE IS ARMED

MACH FEEL SYSTEM MONITOR AND CONTROL SWITCHES

IN

FAIL IS ILLUMINATED WHEN MONITOR HAS DETECTED A FAULT IN A CHANNEL AND HAS AUTOMATICALLY DEACTIVATED THE CHANNEL. CERTAIN FAULTS IN A SINGLE CHANNEL MAY DEACTIVATE BOTH CHANNELS

OUT

CHANNEL IS DEENERGIZED. ONE CHANNEL PROVIDES NORMAL SYSTEM OPERATION. WITH BOTH CHANNELS OFF FEEL FORCE REMAINS AT VALUE THAT EXISTED ON FAILURE. OFF INDICATES SWITCH POSITION

MANUAL RUDDER LIMITING SWITCH

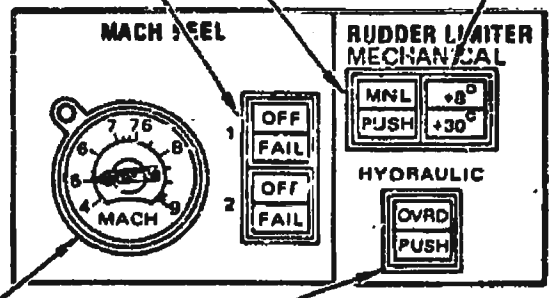
PERMITS MANUAL SELECTION OF 8° OR 30° RUDDER TRAVEL. AUTO/MANUAL MECHANICAL LIMITER SWITCH MUST BE OUT. EITHER THE 8° OR 30° LIGHT WILL BE OUT.

IN

SELECTS FULL RUDDER TRAVEL OF 30° BY REMOVING MECHANICAL STOPS.

OUT

LIMITS RUDDER TRAVEL TO 8° BY POSITIONING MECHANICAL STOPS



MACH FEEL INDICATOR

NORMAL SYSTEM OPERATION IS INDICATED WHEN READOUT CORRESPONDS TO AIRCRAFT MACH NUMBER. NULLS TO 0.73 WITH LOSS OF POWER TO INDICATOR. WHEN BOTH CHANNELS FAIL, MACH INDICATOR REMAINS AT INDICATION SHOWN AT TIME OF FAILURE

RUDDER HYDRAULIC POWER LIMITER SWITCH

PROVIDES MONITORING AUTOMATIC SYSTEM AND CONTROLLING RUDDER HYDRAULIC PRESSURE

IN

NORMAL POSITION. NO LIGHTS ILLUMINATED. PUSH SWITCH LEGEND, AND RUDDER HYDR LMTR AND FLT CONT PANELS ON THE MASTER ANNUNCIATOR PANEL ARE ILLUMINATED WHEN RUDDER POWER CHANNELS A AND C ARE INOPERATIVE WITH FLAPS UP OR WHEN FULL RUDDER POWER CONTROL IS NOT AVAILABLE WITH FLAPS DOWN

OUT

PUSH IS EXTINGUISHED AND OVRD IS ILLUMINATED TO INDICATE AUTOMATIC HYDRAULIC RUDDER LIMITING IS DEACTIVATED. ALSO, ALL AVAILABLE HYDRAULIC SYSTEM PRESSURE IS RESTORED

FLIGHT CONTROL PANEL

IN NORMAL OPERATION ALL SWITCHES ARE LATCHED AND NONE ARE ILLUMINATED. FAIL AND PUSH LIGHTS ARE ARMED.

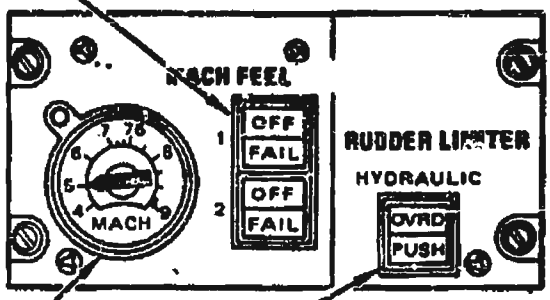
M1-0100-22-381

Flight Control Panel
Figure 12

MACH FEEL SYSTEM MONITOR AND CONTROL SWITCHES

IN
FAIL is illuminated when monitor has detected a fault in a channel and has automatically deactivated the channel. Certain faults in a single channel may deactivate both channels

OUT
Channel is deenergized. One channel provides normal system operation. With both channels off, feel force remains at value that existed on failure. Indicates switch position



MACH FEEL INDICATOR

Normal system operation is indicated when readout corresponds to aircraft MACH number. Nulls to 0.73 with loss of power to indicator. When both channels fail, MACH indicator remains at indication shown at time of failure

RUDDER HYDRAULIC POWER LIMITER SWITCH

Provides monitoring automatic system and controlling rudder hydraulic pressure

IN
Normal position. No lights illuminated. PUSH switch legend, and RUDDER HYDR LMTR and FLT CONT PANELS on the master annunciator panel are illuminated when rudder power channels A and C are inoperative with flaps up or when full rudder power control is not available with flaps down

OUT
PUSH is extinguished and OVRD is illuminated to indicate automatic hydraulic rudder limiting is deactivated. Also, all available hydraulic system pressure is restored

FLIGHT CONTROL PANEL
In normal operation, all switches are latched and none are illuminated. Fail and push lights are armed.

M1-0000-22-055

Flight Control Panel
Figure 12

If both switchlights indicate FAIL, one of the Mach feel system channels may still be operational. In this case, both channels are turned off at once. Finding an operating channel is performed by depressing one channel switchlight at a time.

The MACH indicator is calibrated in Mach number. The indicator is used to monitor the performance of the Mach feel system.

(2) On aircraft 001-017,
R Rudder Mechanical Limiter Control

Two RUDDER LIMITER MECHANICAL switchlights are used to monitor and control the rudder mechanical limiter. The switchlights are dark under normal mechanical limiter control operation. When a failure occurs in the mechanical limiter control, the PUSH legend on the first (left) switchlight comes on. When the switchlight is depressed, the PUSH legend goes off and the MNL legend comes on to indicate that manual control is on. At this time, the rudder mechanical limiter is retracted fully for a full rudder deflection (±30 degrees), as indicated by the ±30 degree legend on the second (right) switchlight. To extend the mechanical limiter to limit the rudder deflection to ±8 degrees, the second switchlight is momentarily depressed, which causes the ±30-degree legend to go off and the ±8-degree legend to come on.

(3) Rudder Hydraulic Limiter Control

The HYDRAULIC switchlight in the RUDDER LIMITER section is used to monitor the rudder hydraulic power control and to engage the manual mode. The switchlight is dark under normal hydraulic power control operation. The PUSH legend on the switchlight comes on when loss of hydraulic power to the rudder servo systems A and C occurs. The PUSH legend also comes on for all other failures when the flaps are extended. When the switchlight is depressed, the PUSH legend goes off and the OVRD legend comes on. The OVRD legend indicates that all rudder servo hydraulic shutoff solenoids are deactivated to allow all three hydraulic systems (A, B, and C) to supply the rudder servo.

10. Flight Control Auxiliary Unit

A. Description

The flight control auxiliary unit (FCAU) is used to monitor and test the spoiler mode control and rudder hydraulic limiter systems (Ref. Fig. 13). The FCAU contains monitoring indicators, non-latching pushbutton switches, and a non-latching toggle switch mounted on the front panel. Three connectors are provided on left side of the unit for electrical interfaces. The front panel is divided into the following two sections:

(1) The SPOILERS section contains a double-pole momentary toggle switch, three indicators, and a two-pole momentary pushbutton switch.

(2) The RUDDER HYDRAULIC LIMITER section contains a message-bearing indicator, four indicating lamps and associated single-pole momentary pushbutton switches, and a single-pole momentary pushbutton switch (lamp test switch for both sections).

B. Operation of SPOILERS Section (Ref. Fig. 14)

(1) Spoiler Mode Control System Monitor

The FCAU monitors:

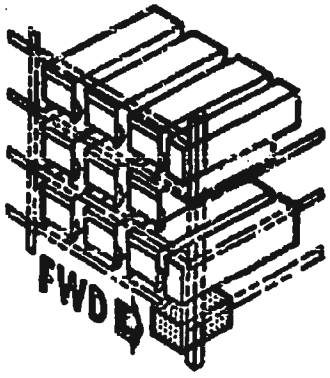
- The position of the left and right spoiler No. 1 servo SOV by means of a hydraulic pressure switch in each servo.

- The position of the left and right selector drive actuators by means of the extend/retract switches in each actuator.

- The position of the left and right mixer drive actuators by means of the extend/retract switches in each actuator.

The FCAU then compares the flap position against the monitored state of the No. 1 spoilers and against the monitored position of the selector drive and mixer actuators. When a disagreement occurs between the flap position and the actuator position or the spoiler No. 1 state, warnings are displayed on the FCAU, the PFCS monitor/control panel, and the caution and warning panel (CAWP). The warning indicators go out when the fault has been corrected.

The SPOILER 1 FAULT light on the FCAU comes on when either the left or right No. 1 spoiler pressure switch position does not agree with the flap switch position. It also comes on when the flaps are down and the No. 1 spoiler override bungee switch detects a jam, and shuts



FORWARD ELECTRONIC SERVICE CENTER, CENTER RACK

SELECTOR FAULT LIGHT
Indicates a failure in either the R or L selector drive actuator.

SPOILER 1 FAULT LIGHT
Indicates a failure in either the R or L No. 1 SPLR servo. Also indicates Spoiler No. 1 JAM when flaps are down.

MANUAL SWITCH
When depressed, activates flaps UP/DOWN switch; interrupts power to L and R SPLR servo shutoff valves (same as flaps down); and interrupts power to mixer and power relays K1 and K2.

FLAPS SWITCH IN UP POSITION
Energizes L and R SPLR servo shutoff valves (SOV) and energizes mixer and selector power (flaps up) relay K1.

IN DOWN POSITION
Energizes mixer and selector power (flaps down) relay K2.

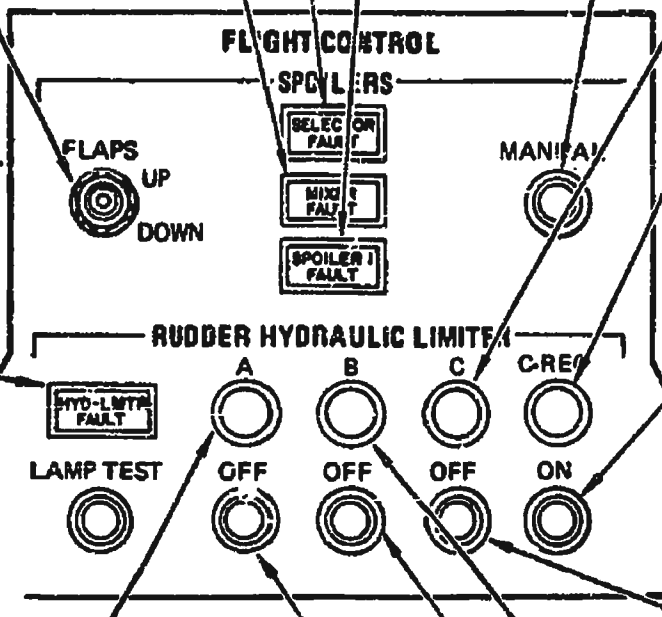
MIXER FAULT LIGHT
Indicates a failure in either the R or L mixer actuator.

C LIGHT
Indicates rudder power servo SOV closed (HYD C).

C-REG LIGHT
Light off when rudder HYD C press. 3,000 PSI. Light on when rudder HYD C PRESS. is 2,000 PSI or less.

C-REG SWITCH
When depressed, energized rudder PRESS. regulator (HYD C).

HYD-LMTR FAULT LIGHT
Indicates one or more of the following faults sensed by the LRS computer:
- LRS computer fault.
- ADC-1 or -2 fault.
- HYD to rudder actuator:
  - A removed below 164 Knots or not removed above 164 Knots.
  - B removed below 164 Knots or not removed above 164 Knots.
  - C removed at any airspeed.
  - C regulated (2000 psi) below 260 Knots.
  - C not regulated (3000 psi) above 260 Knots.



A SWITCH
When depressed, closes rudder power servo SOV (HYD A).

A LIGHT
Indicates rudder power servo SOV closed (HYD A).

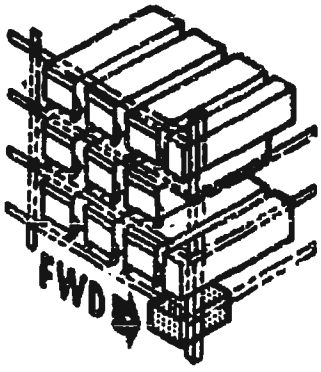
C SWITCH
When depressed, closes rudder power servo SOV (HYD C).

B LIGHT
Indicates rudder power servo SOV closed (HYD B).

B SWITCH
When depressed, closes rudder power servo SOV (HYD B).

M1-37901-22-382

Flight Control Auxiliary Unit
Figure 13



FORWARD ELECTRONIC SERVICE CENTER, CENTER RACK

SPOILER 1 FAULT LIGHT
Indicates a failure in either the R or L No. 1 SPLR servo. Also indicates Spoiler No. 1 JAM when flaps are down.

MANUAL SWITCH
When depressed, activates flaps UP/DOWN switch; interrupts power to L and R SPLR servo shutoff valves (same as flaps down); and interrupts power to mixer and power relays K1 and K2.

SELECTOR FAULT LIGHT
Indicates a failure in either the R or L selector drive actuator.

MIXER FAULT LIGHT
Indicates a failure in either the R or L mixer actuator.

FLAPS SWITCH IN UP POSITION
Energizes L and R SPLR servo shutoff valves (SOV) and energizes mixer and selector power (flaps up) relay K1.

IN DOWN POSITION
Energizes mixer and selector power (flaps down) relay K2.

C LIGHT
Indicates rudder power servo SOV closed (HYD C).

C-REG LIGHT
Light off when rudder HYD C press. 3,000 PSI. Light on when rudder HYD C PRESS. is 2,000 PSI or less.

C-REG SWITCH
When depressed, energized rudder PRESS. regulator (HYD C).

HYD-LMTR FAULT LIGHT
Indicates one or more of the following faults sensed by the LRS computer:
- LRS computer fault.
- ADC-1 or -2 fault.
- HYD to rudder actuator:
  - A removed below 164 Knots or not removed above 260 Knots.
  - C removed at any airspeed.
  - C regulated (2000 psi) below 164 Knots.
  - C not regulated (3000 psi) above 164 Knots.

A SWITCH
When depressed, closes rudder power servo SOV (HYD A).

A LIGHT
Indicates rudder power servo SOV closed (HYD A).

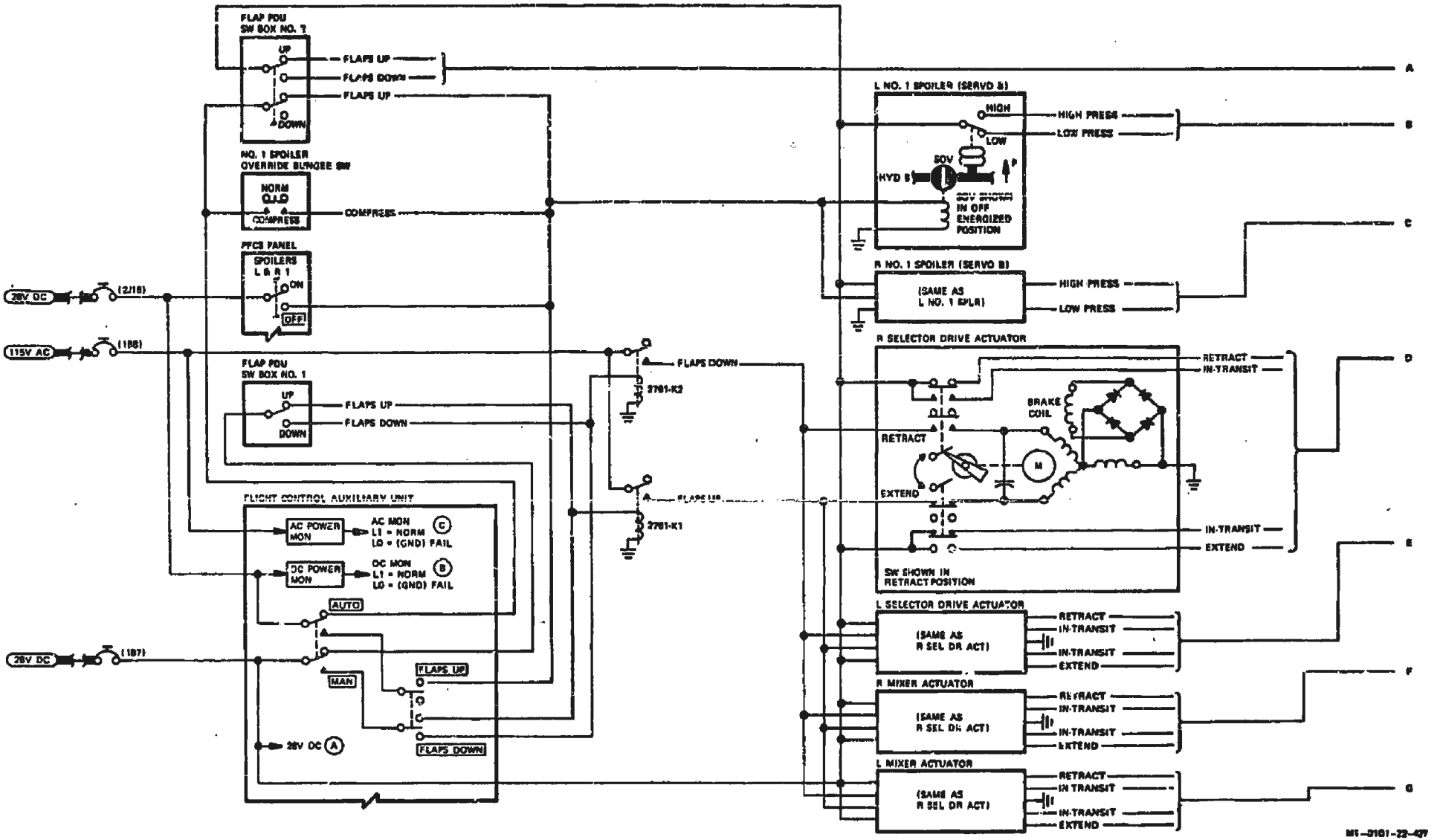
C SWITCH
When depressed, closes rudder power servo SOV (HYD C).

B LIGHT
Indicates rudder power servo SOV closed (HYD B).

B SWITCH
When depressed, closes rudder power servo SOV (HYD B).

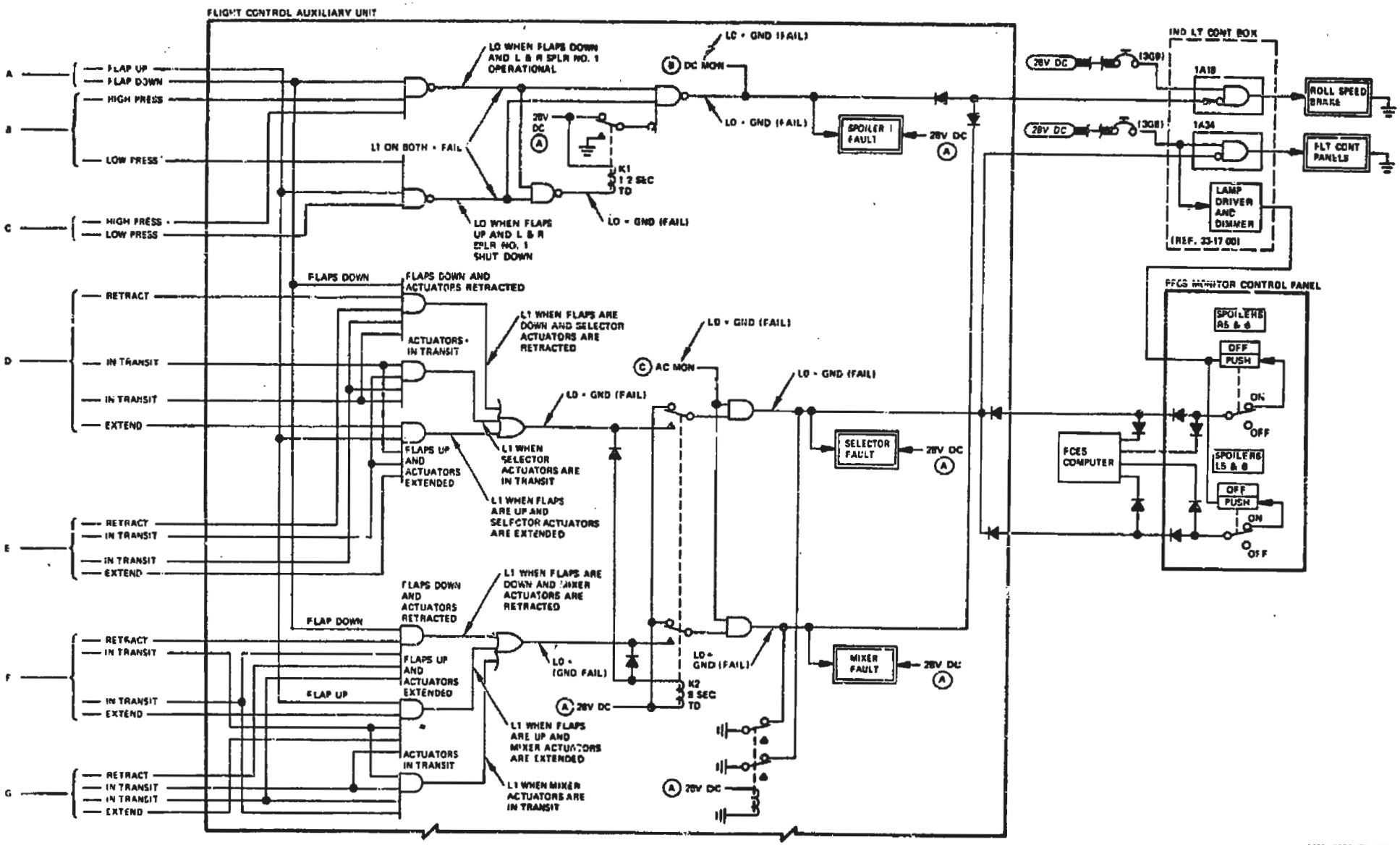
M1-39700-22-430

Flight Control Auxiliary Unit
Figure 13



Spoiler Mode Control (FCAU) Simplified Schematic
Figure 14 (Sheet 1)

R
R
001B EFFECTIVITY: ALL



EMI-0100-22-432

Spoiler Mode Control (FCAU) Simplified Schematic
Figure 14 (Sheet 2)

off both No. 1 spoiler servos. In the cockpit, the ROLL SPEED BRAKES legend also comes on when the SPOILER 1 FAULT light comes on. (Normal spoiler No. 1 operation: Flaps up = servo low pressure; Flaps down = servo high pressure).

The SELECTOR FAULT light on the FCAU comes on when either the left or right selector drive actuator switch position does not agree with the flap switch position. In the cockpit, the FLT CONT PANELS legend on the CAWP, and the SPOILERS L5 & 6 and SPOILERS R5 & 6 "PUSH" legends on the PFCS monitor panel also come on when the SELECTOR FAULT light comes on. (Normal selector drive actuator operation: Flaps up = extend switches in extend position and retract switches in in-transit position; Actuator in motion = all switches in in-transit position; and Flaps down = extend switches in in-transit position and retract switches in retract position).

The MIXER FAULT light on the FCAU comes on when either the left or right mixer actuator switch position does not agree with the flap switch position. In the cockpit, the ROLL SPEED BRAKE legend also comes on when the MIXER FAULT light comes on. (Normal mixer actuator operation is the same as the selector drive actuator operation).

(2) Spoiler Mode Control System BITE

The FCAU BITE test permits overriding the normal state of the spoiler mode control system and commanding the opposite state. (For example, commanding a flaps-down configuration when the flaps are normally up.) In this manner, a fault condition is introduced into all mechanisms and all monitor displays should indicate faults (MIXER FAULT, SELECTOR FAULT, and SPOILER 1 FAULT).

The BITE test is performed by depressing the MANUAL switch and placing the FLAPS switch in the UP position (if the flaps are down) or in the DOWN position (if the flaps are up). On the FCAU, the SELECTOR FAULT, the MIXER FAULT, and the SPOILER 1 FAULT legends come on. In the cockpit, the ROLL SPEED BRAKES and FLT CONT PANELS legends on the CAWP come on, and the SPOILERS L5 & 6 and SPOILERS R5 & 6 "PUSH" legends on the PFCS monitor panel come on. All of the fault indicators go out when the FLAPS switch on the FCAU is positioned to correspond with the flap position.

The LAMP TEST switch is used to test all indicators on the FCAU. All indicators come on when the switch is depressed.

C. Operation of RUDDER HYDRAULIC LIMITER Section (Ref. Fig. 15)

(1) Rudder Hydraulic Limiter System Monitor

The FCAU monitors:

- The three (hydraulic systems A, B, and C) rudder servo SOV positions by means of a hydraulic pressure switch in each servo module.
- The state of the hydraulic C system pressure regulator by means of a pressure switch.
- The overall hydraulic limiter system by means of the HYD LMTR FAULT legend.

The RUDDER HYDRAULIC LIMITER lamps A, B, or C on the FCAU come on whenever hydraulic systems A, B, or C to the rudder actuator is removed. The C-REG lamp comes on when hydraulic system C pressure to the rudder actuator is less than 2000 psi.

The HYDR LMTR FAULT legend on the FCAU comes on when one or more of the following faults are sensed by the LRS computer:

- LRS computer fault.
- ADC-1 or ADC-2 fault.
- Hydraulic system C power to rudder actuator is removed at any airspeed.

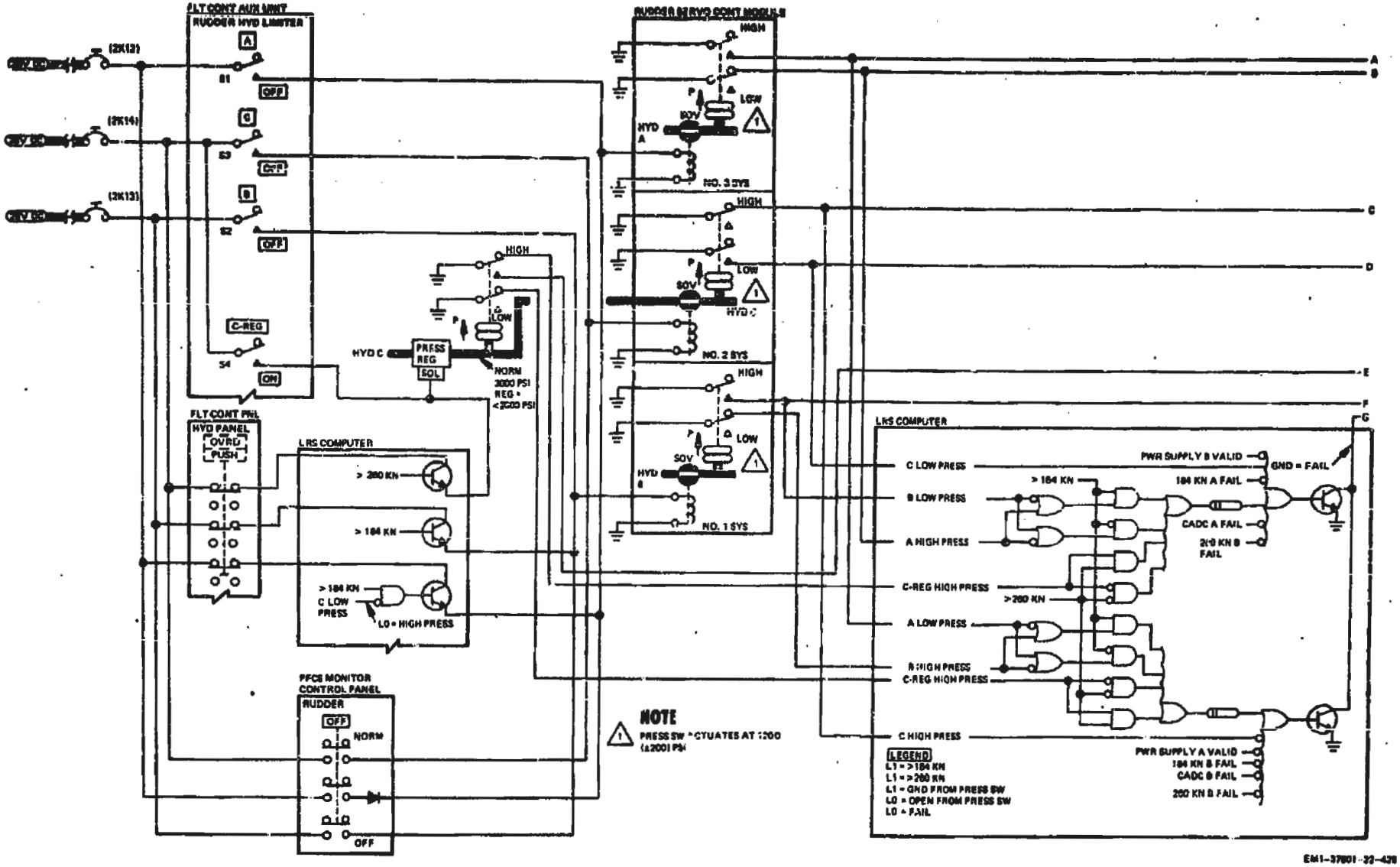
R On aircraft 001-017:

R
R
R
- Hydraulic system A power to rudder actuator is removed below 164 knots or not removed above 164 knots.

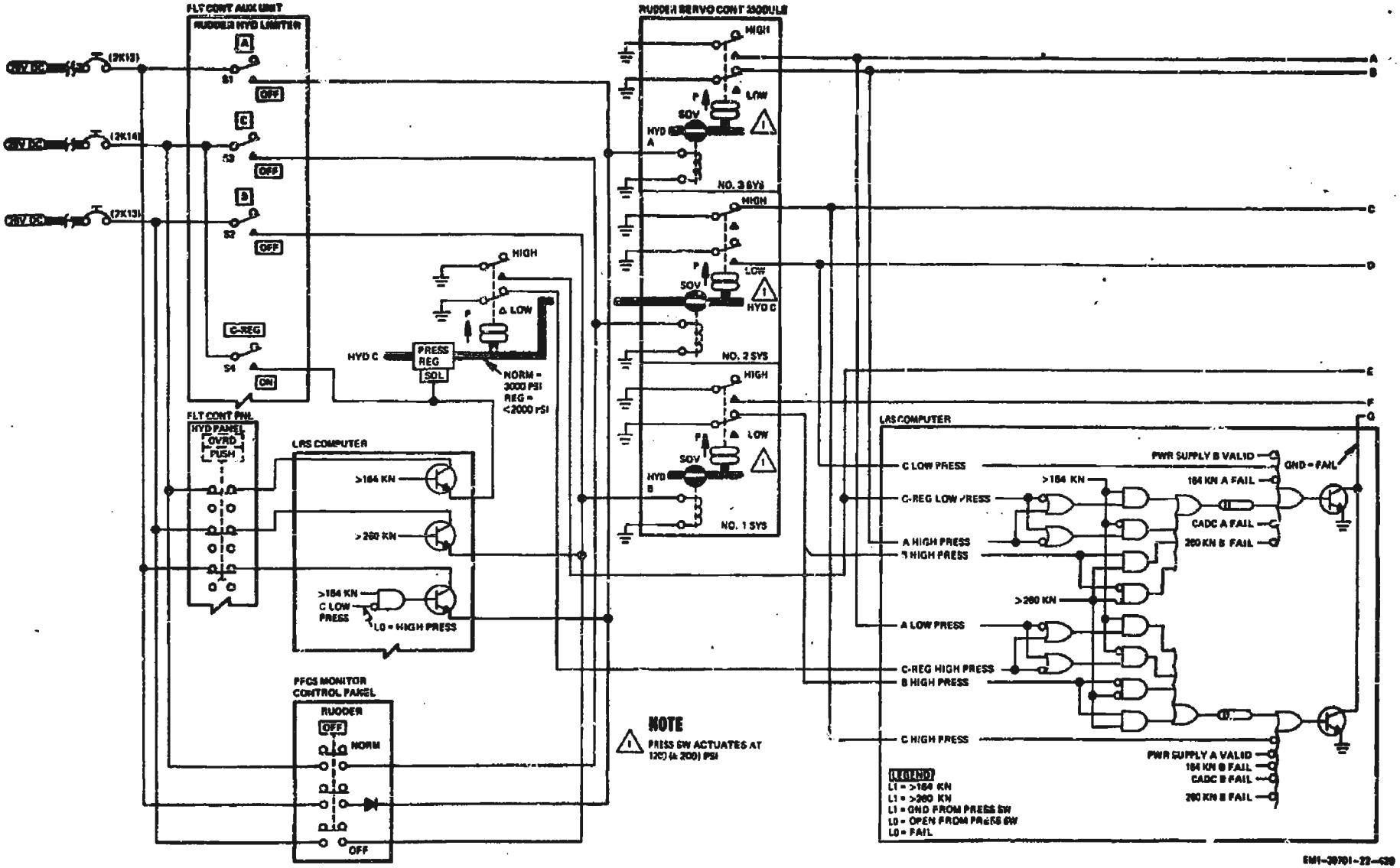
R
R
R
- Hydraulic system B power to rudder actuator is removed below 164 knots or not removed above 164 knots.

R
R
- Hydraulic system C power is regulated (2000 psi) below 260 knots.

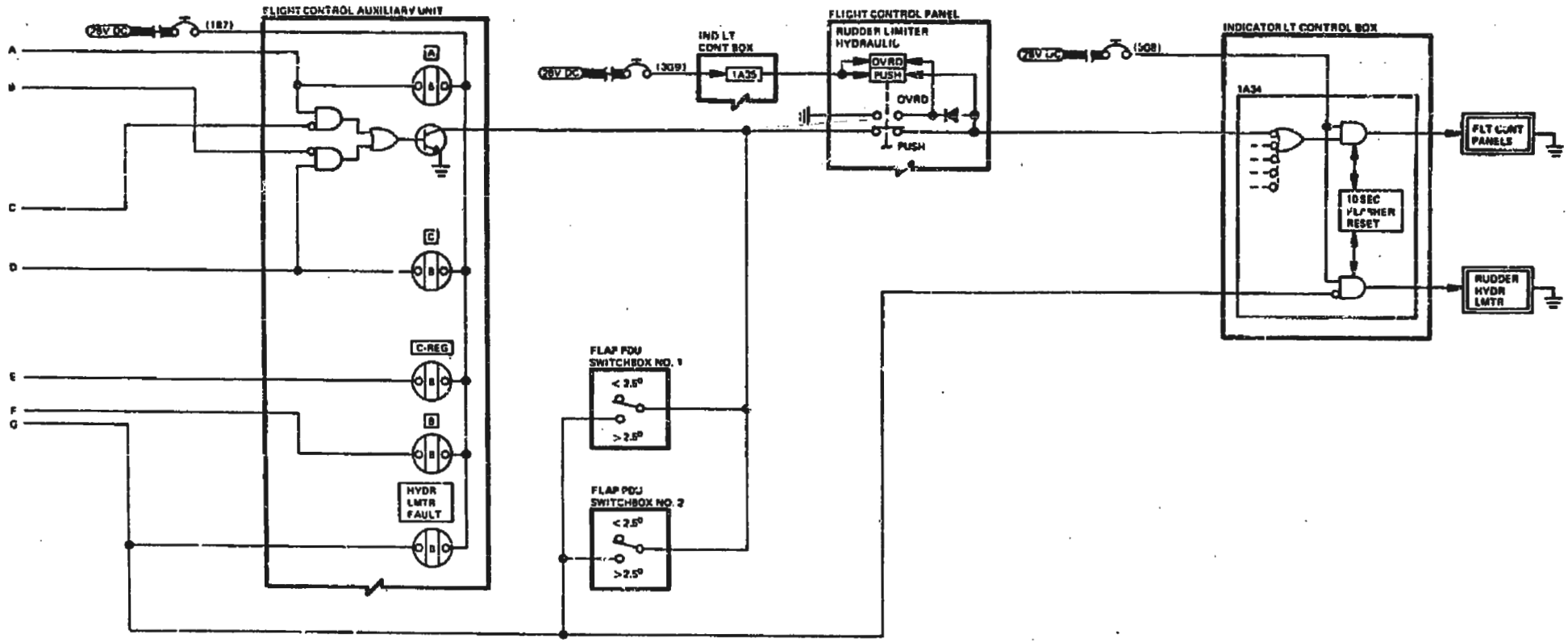
R
R
- Hydraulic system C power is not regulated (3000 psi) above 260 knots.



Rudder Hydraulic Limiter (FCAU) Simplified Schematic
Figure 15 (Sheet 1)



Rudder Hydraulic Limiter (FCAU) Simplified Schematic
Figure 15 (Sheet 1)



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Rudder Hydraulic Limiter (FCAU) Simplified Schematic
Figure 15 (Sheet 2)

R
R
0018 EFFECTIVITY: ALL

R On aircraft 018-999:

R • Hydraulic system A power to rudder actuator is
R removed below 164 knots or not removed above 164
R knots.

R • Hydraulic system B power to rudder actuator is
R removed below 260 knots or not removed above 260
R knots.

R • Hydraulic system C power is regulated (2000
R psi) below 164 knots.

R • Hydraulic system C power is not regulated (3000
R psi) above 164 knots.

In the cockpit, the RUDDER HYDRAULIC LMTR legend on the CAWP also comes on when the HYDR LMTR FAULT legend on
R the FCAU comes on (flaps up). If the flaps are down, the RUDDER LIMITER HYDRAULIC "PUSH" legend on the flight control panel and the FLT CONT PANELS legend on the CAWP also come on when the HYDR LMTR FAULT legend comes on.

When flaps are up, loss of hydraulic systems A and C to the rudder actuator is sensed by the FCAU and turns on the RUDDER LIMITER HYDRAULIC "PUSH" legend on the flight control panel and the FLT CONT PANELS legend on the CAWP in addition to the A and C lamps and the HYDR LMTR FAULT legend on the FCAU, and the RUDDER HYDR LMTR legend on the CAWP.

(2) Rudder Hydraulic Limiter System BITE

The FCAU BITE test permits energization and monitoring of hydraulic systems A, B, C and C-REG power to the rudder actuator.

When RUDDER HYDRAULIC LIMITER switch A, B, or C is depressed; the corresponding lamp and the HYD LMTR FAULT legend come on and remain on until the switch is released. This indicates that the corresponding rudder servo SOV, the FCAU, and the LRS computer operate properly. When the C-REG switch is depressed, the C-REG lamp and the HYD LMTR FAULT legend come on and remain on until the switch is released. This indicates that the C-REG engages properly, and that the FCAU and the LRS computer are operating properly.

In the cockpit, the RUDDER HYDRAULIC LMTR legend on the CAWP also comes on when the HYDR LMTR FAULT legend on the FCAU comes on when (flaps up). If the flaps are

down, the RUDDER LIMITER HYDRAULIC "PUSH" legend on the flight control panel and the FLT CONT PANELS legend on the CAWP also come on when the HYDR LMTR FAULT legend comes on.

When the flaps are up, depressing switches A and C turns on the RUDDER LIMITER HYDRAULIC "PUSH" legend on the flight control panel and the FLT CONT PANELS legend on the CAWP in addition to the A and C lamps and the HYDR LMTR FAULT legend on the FCAU, and the RUDDER HYDR LMTR legends on the CAWP.

APFDS ENGAGE PANEL - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-10-01 APFDS ENGAGE Panel - Adjustment and Test

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL
R SYSTEM - AFCS MODE IND (B1 and B19).

(2) Loosen captive screws on APFDS ENGAGE panel located on glareshield panel, zone 210.

(3) Pull out panel sufficiently from glareshield panel to disconnect electrical connectors, and remove panel.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Connect electrical connectors to APFDS ENGAGE panel.

(3) Insert APFDS ENGAGE panel into glareshield panel and secure.

(4) Remove tags and close circuit breakers opened in Step A(1).

R (5) Perform APFDS ENGAGE panel adjustment and test (Ref.
R 22-10-01).

APFDS ENGAGE PANEL - ADJUSTMENT AND TEST

1. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
34-21-00	Attitude Reference System - Adjustment and Test

2. Adjustment/Test

The APFDS ENGAGE panel operational test provided below requires that all other autoflight system components and associated equipment are installed and operational.

A. Operational Test

WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Turn on electrical power (Ref. 24-41-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) Turn on attitude reference system (Ref. 34-21-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(4) Turn on hydraulic power (Ref. 29-11-00).

(5) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

AFCS MODE IND (B1) and (B19)

NO. 1 SYSTEMS

YAW SAS (A5)

PITCH & ROLL (A6)

TRIM AGMT - AC (A7)

TRIM AGMT - DC (A8)

NO. 2 SYSTEMS

YAW SAS (A23)

PITCH & ROLL (A24)

TRIM AGMT - AC (A25)

TRIM AGMT - DC (A26)

(6) Set autopilot engage switch A to CMD. Verify that switch remains latched in CMD position.

(7) Depress TURB switchlight. Verify that TURB switchlight comes on and autopilot engage switch A drops to CWS position.

(8) Depress TURB switchlight. Verify that TURB switchlight goes off.

(9) Set autopilot engage switch A to OFF and switch B to CMD. Verify that switch B remains latched in CMD position.

(10) Depress TURB switchlight. Verify that TURB switchlight comes on and autopilot engage switch B drops to CWS position.

(11) Depress TURB switchlight to off and set autopilot engage switch B to OFF.

(12) Set left FD switch to ON. Verify that command bars on Captains attitude director indicator come into view.

(13) Set right FD switch to ON. Verify that command bars on First Officers attitude director indicator come into view.

(14) Set both FD switches to OFF.

(15) Turn off attitude reference system (Ref. 34-21-00).

(16) Turn off hydraulic power (Ref. 29-11-00).

(17) Turn off electrical power (Ref. 24-41-00).

NAVIGATION MODE SELECT PANEL - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-10-02 Navigation Mode Select Panel - Adjustment and Test

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL
R SYTEM - AFCS MODE IND (B1 and B19).

(2) Loosen captive screws on NAV MODE select panel located on glareshield panel, zone 210.

(3) Pull out NAV MODE panel sufficiently from glareshield panel to disconnect electrical connectors, and remove panel.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Connect electrical connectors to NAV MODE panel.

(3) Insert NAV MODE panel into glareshield panel and secure.

(4) Remove tags and close circuit breakers opened in Step A(1).

R (5) Perform navigation mode select panel adjustment and
R test (Ref. 22-10-02).

NAVIGATION MODE SELECT PANEL - ADJUSTMENT AND TEST

1. Equipment and Materials

VOR/ILS Ramp Test Set T-30, or equivalent

2. Referenced Procedures

R R	21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
	24-00-00	Electrical Power - Maintenance Practices
	34-14-00	Central Air Data Computer System - Maintenance Practices
	34-21-00	Attitude Reference System - Maintenance Practices
	34-22-00	Magnetic Heading Reference System - Maintenance Practices
	34-33-00	Instrument Landing System - Maintenance Practices
	34-55-00	VOR System - Maintenance Practices

3. Adjustment/Test

The navigation mode (NAV MODE) select panel operational test provided below requires that all other autoflight system components and associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) Verify that the following navigation systems are on:

Central air data computer system (Ref. 34-14-00).

Attitude reference system (Ref. 34-21-00).

Magnetic heading reference system (Ref. 34-22-00).

Instrument landing system (Ref. 34-33-00).

VOR system (Ref. 34-55-00).

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - PITCH & ROLL (A6)

AFCS MODE IND (B1)

NO. 2 SYSTEMS - PITCH & ROLL (A24)

AFCS MODE IND (B19)

B. Functional Test

(1) On pilots overhead panel, depress WARNING CAUTION ADVISORY TEST switch. Verify that A/L, APR, LOC and NAV lights on NAV MODE panel are on.

(2) Depress WARNING CAUTION ADVISORY TEST switch. Verify that A/L, APR, LOC and NAV lights go out.

(3) On NAV MODE panel, set VOR selector to SPLIT position.

(4) Using VOR/ILS test set, establish a VOR output at 108.0 MHz.

(5) Set VOR systems 1 and 2 to a frequency of 108.0 MHz.

(6) On COMPASS controllers 1 and 2, depress MAG/DG switchlights to turn on DG lights.

(7) Using slew knob on COMPASS controllers 1 and 2, slew Captain and First Officers HSI heading dials to 100 degrees.

(8) On NAV MODE panel, set both COURSE knobs to 100 degrees.

R (9) On VOR test set, adjust VARIABLE control for a 2-dot right-deflection of course deviation bars on both HSI.

(10) On APFDS ENGAGE panel, set FD A switch to ON. Verify that command bar is centered and level on Captains ADI.

(11) On NAV MODE panel, depress NAV switchlight to turn on NAV light. Verify that VOR ARM is displayed on Captains AFCS MODES annunciator.

(12) On NAV MODE panel, turn left COURSE knob clockwise until course deviation bar indicates zero deviation on Captains HSI. On Captains AFCS MODES annunicator, VOR ARM is removed and VOR capture is displayed within one minute.

(13) On APFDS ENGAGE panel, set FD A switch to OFF. On NAV MODE panel, NAV light goes out. On Captains AFCS MODES annunciator, VOR is removed.

(14) On NAV MODE panel, set left COURSE knob to 100 degrees.

(15) On APFDS ENGAGE panel, set FD B switch to ON.

(16) On NAV MODE panel, depress NAV switchlight to turn on NAV light. On First Officers AFCS MODES annunciator, VOR ARM is displayed. On First Officers ADI, command bar is centered and level.

(17) On NAV MODE panel, turn right COURSE knob clockwise until course deviation bar on First Officers HSI indicates zero deviation. On First Officers AFCS MODES annunciator, VOR ARM is removed and VOR capture is displayed within one minute.

(18) On APFDS ENGAGE panel, set FD B switch to OFF. On NAV MODE panel, NAV light goes out. On First Officers AFCS MODES annunciator, VOR is removed.

(19) On NAV MODE panel, set right COURSE knob to 100 degrees.

(20) On APFDS ENGAGE panel, set FD A and FD B switches to ON.

(21) On NAV MODE panel, depress NAV switchlight to turn on NAV light. On both AFCS MODES annunciators, VOR ARM indications are displayed. On both ADI, command bars are centered and level.

R

(22) On NAV MODE panel, set VOR switch to 1.

(23) On NAV MODE panel, turn left COURSE knob clockwise until course deviation bars indicate zero deflection on Captains HSI. On both AFCS MODES annunicators, VOR ARM indications are removed, and VOR capture indications are displayed within one minute.

(24) On NAV MODE panel, depress NAV switchlight to turn off NAV light. VOR switch automatically moves to SPLIT position. On both AFCS MODES annunicators, VOR indications are removed.

(25) On NAV MODE panel, set left COURSE knob to 100 degrees.

(26) On NAV MODE panel, depress switchlight to turn on NAV light. On both AFCS MODES annunciators, VOR ARM indications are displayed. On both ADI, command bars are centered and level.

R

(27) On NAV MODE panel, set VOR switch to 2.

(28) On NAV MODE panel, turn right COURSE knob clockwise until course deviation bars indicate zero deviation on First Officers HSI. On both AFCS MODES annunciators, VOR ARM indications are removed and VOR capture indications are displayed within one minute.

(29) On VOR test set, adjust VARIABLE control for a 1-dot right-deflection of course deviation bars on both HSIs. Both ADI command bars indicate right roll within 30 seconds.

(30) On NAV MODE panel, depress NAV switchlight to turn off NAV light. VOR switch automatically moves to SPLIT position. On both AFCS MODES annunciators, VOR indication is removed.

(31) Set ILS system 1 and 2 to a frequency of 108.1 MHz.

(32) On NAV MODE panel, depress LOC switchlight to turn on LOC light. On both AFCS MODES annunciators, LOC ARM indications are displayed. On both ADIs, command bars are centered and level.

(33) On NAV MODE panel, depress APR switchlight to turn on APR light. LOC light goes out. On both AFCS MODES annunciators, LOC ARM and GS ARM indications are displayed. On both ADIs, command bars are centered and level.

(34) On NAV MODES panel, depress A/L switchlight to turn on A/L light. APR light goes out. On both AFCS MODES annunciators, LOC ARM and GS ARM indications are displayed. On both ADIs, command bars are centered and level.

(35) On NAV MODE panel, depress A/L switchlight to turn off A/L light. On both AFCS MODES annunciators, indications are removed.

(36) On APFDS ENGAGE panel, set FD A and B switches to OFF.

C. Test Completion

(1) Turn off electrical power (Ref. 24-00-00).

HEADING/PITCH MODE COMMAND PANEL - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-10-03 Heading/Pitch Mode Command Panel - Adjustment and Test

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND (B1 and B19).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker AFCS WARNING - CAPT (K18).

(2) Loosen captive screws on HEADING/PITCH MODE command panel located on glareshield panel, zone 210.

(3) Pull out HEADING/PITCH MODE panel sufficiently from glareshield panel to disconnect electrical connectors, and remove panel.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Connect electrical connectors to HEADING/PITCH MODE command panel.

(3) Insert HEADING/PITCH MODE panel into glareshield panel and secure.

(4) Remove tags and close circuit breakers opened in Step A(1).

R (5) Perform heading/pitch mode command panel adjustment and test (Ref. 22-10-03).

HEADING/PITCH MODE COMMAND PANEL - ADJUSTMENT AND TEST

1. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices
34-14-00	Central Air Data Computer System - Adjustment and Test
34-21-00	Attitude Reference System - Adjustment and Test
34-22-00	Magnetic Heading Reference System - Adjustment and Test

2. Adjustment/Test

R The HEADING/PITCH MODE command panel operational test provided below requires that all other auto flight system components and associated equipment are installed and operational.

A. Operational Test

(1) Turn on electrical power (Ref. 24-41-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) Turn on the following navigation systems:

Central air data computer system (Ref. 34-14-00)

Attitude reference system (Ref. 34-21-00)

Magnetic heading reference system (Ref. 34-22-00)

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - PITCH & ROLL (A6)

AFCS MODE IND (B1 and B19)

NO. 2 SYSTEMS - PITCH & ROLL (A24)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breakers AFCS WARNING - CAPT (K18) and AFCS WARNING - F/O (K19) are closed.

(5) On APFDS ENGAGE panel, set both FD switches to ON.

(6) Depress VS, ALT, IAS, and MACH mode switchlights in sequence. Verify that depressed mode switchlight comes on and previously selected mode is cancelled.

(7) Depress (engage) VS mode switchlight.

(8) Rotate VERT SPEED selector in DN direction. Verify that VERT SPEED counter responds, and pitch command bar on attitude director indicators shows down command.

(9) Depress (disengage) VS mode switchlight.

(10) Operate self-test switch on central air data computer (Ref. 34-14-00). Verify that VERT SPEED counter jumps to approximately 300, then returns to zero when air data flag appears in instruments.

(11) Depress HDG mode switchlight. Verify that switchlight comes on.

(12) Vary HEADING selector. On attitude director indicators, verify that roll command bar follows heading changes and is centered when HEADING counter reads lubber line heading (on horizontal situation indicators).

(13) Depress (disengage) HDG mode switchlight. Verify that switchlight goes off.

(14) Turn off the following navigation systems:

Central air data computer system (Ref. 34-14-00)

Attitude reference system (Ref. 34-21-00)

Magnetic heading reference system (Ref. 34-22-00)

(15) Turn off electrical power (Ref. 24-00-00).

AFCS MODES ANNUNCIATOR INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedures

22-10-05 AFCS MODES Annunciator Indicator - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag one of the following circuit breakers, as applicable:

Left AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND (B1)

Right AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND (B19)

(2) Loosen roundhead instrument clamp adjusting screws on face of instrument panel to release clamp (Ref. Fig. 401).

(3) Remove indicator from front of instrument panel.

(4) Disconnect electrical connector from indicator.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

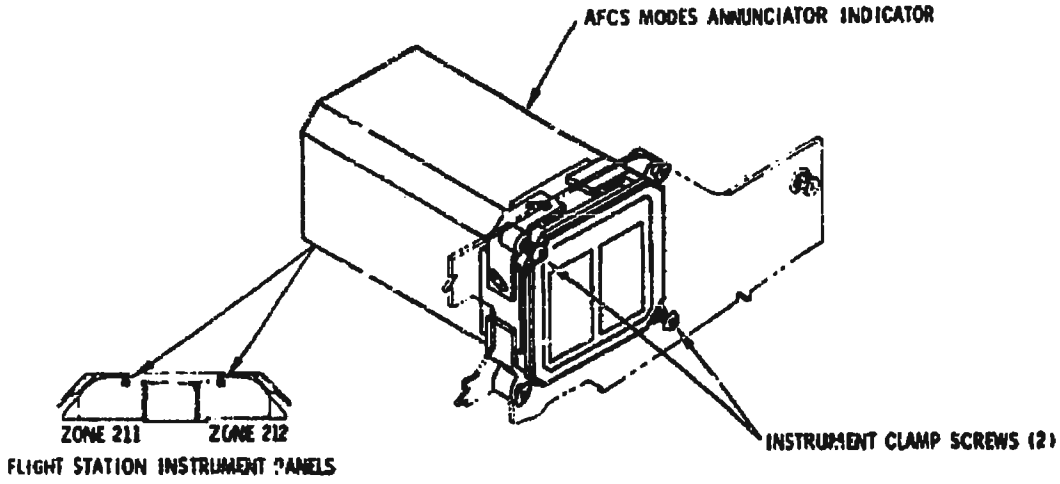
(2) Connect electrical connector to indicator.

(3) Insert AFCS MODES annunciator indicator (Ref. Fig. 401) into instrument panel.

(4) Torque roundhead clamp adjusting screws on face of instrument panel 5 to 8 lb in.

(5) Remove tag and close circuit breaker opened in Step 2A(1).

(6) Perform AFCS MODES annunciator indicator operational test (Ref. 22-10-05).



MI-0101-22-056

R AFCS MODES Annunciator Indicator - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

AFCS MODES ANNUNCIATOR INDICATOR - ADJUSTMENT AND TEST

1. Referenced Procedures

21-25-00 Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test

24-41-00 External Power/Ground Service System - Maintenance Practices

2. Adjustment/Test

A. Operational Test

(1) Turn on electrical power (Ref. 24-41-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify that one of the following circuit breakers, as applicable, is closed:

Left AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND (B1) for testing Captains AFCS MODES annunciator indicator

Right AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND (B19) for testing First Officers AFCS MODES annunciator indicator

(4) Depress and hold TEST 1 switch on indicator. Verify that the following mode legends come into view:

LOC	HDG SEL
GS	VS
A/L	VOR
ALIGN	IAS
FLARE	TURB
ROLLOUT	GO ARND on aircraft Without SB34-178
	TO/GA on aircraft with SB34-178

(5) Release TEST 1 switch. Verify that all mode legends go out of view.

(6) Depress and hold TEST 2 switch on indicator. Verify that the following mode legends come into view:

	LOC ARM	R NAV
	GS ARM	ALT
	A/L ARM	VOR ARM
	ALN ARM	MACH
	FLR ARM	ALT ARM
CR	TAKEOFF on aircraft without	TEST or "Vendor Logo"
CR	SB34-178	(NOT USED)

(7) Release TEST 2 switch. Verify that all mode legends go out of view.

(8) Turn off electrical power (Ref. 24-41-00).

AFCS WARNING INDICATOR - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-10-06 AFCS WARNING Indicator - Adjustment and Test

R 2. Removal/Installation

A. Removal

R (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker AFCS WARNING - CAPT (K18) or AFCS WARNING - F/O (K19), as applicable.

R (2) Loosen roundhead instrument clamp adjusting screws on face of instrument panel to release clamp (Ref. Fig. 401).

R (3) Remove indicator from front of instrument panel.

R (4) Disconnect electrical connector from indicator.

B. Installation

R (1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

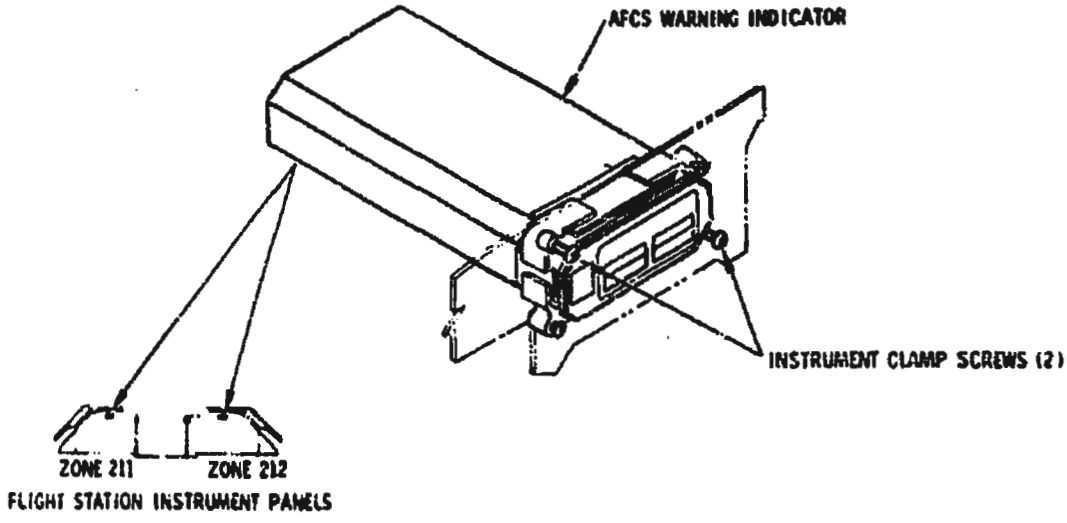
R (2) Connect electrical connector to indicator.

R (3) Insert AFCS WARNING indicator (Ref. Fig. 401) into instrument panel.

R (4) Torque roundhead clamp adjusting screws on face of instrument panel 5 to 8 lb in.

R (5) Remove tag and close circuit breaker opened in Step 2A(1).

R (6) Perform AFCS WARNING indicator operational test (Ref. 22-10-06).



M1-0101-22-06

R AFCS WARNING Indicator - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

0016

AFCS WARNING INDICATOR - ADJUSTMENT AND TEST

1. General

The AFCS warning indicator adjustment and test consists of an AFCS warning indicator operational test, and an AFCS warning indicator functional test. The AFCS warning indicator operational test is performed whenever an AFCS warning indicator is replaced. The AFCS warning indicator functional test insures proper operation and function as related to safety of the aural warning unit and the AFCS warning indicator.

2. Referenced Procedures

R	21-00-00	Air Conditioning - Maintenance Practices
	24-41-00	External Power/Ground Service System - Maintenance Practices
	27-11-00	Aileron Control System - Adjustment and Test
	27-21-00	Rudder Control System - Adjustment and Test
	27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
	27-51-00	Trailing Edge Flap System - Adjustment and Test
	27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices
	32-63-00	Air/Ground Sensing System - Adjustment and Test
	31-22-00	Aural Warning Unit - Adjustment and Test
	34-21-00	Attitude Reference System - Adjustment and Test

3. Adjustment/Test

A. AFCS Warning Indicator Operational Test

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) On FE/SO overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

AFCS WARNING

CAPT (K18)

F/O (K19)

(4) On AFCS WARNING indicator, depress and hold TEST 1 switch. ALERT switchlight flashes, and AP DISC, A/P LIMIT, ATS DISC and NO FLARE messages are displayed.

NOTE: Steps 3A(4) thru 3A(8) check the operation of either the F/O or Capt AFCS WARNING indicator

(5) Release TEST 1 switch. ALERT switchlight goes off, and all messages are removed from indicator.

(6) Depress and hold TEST 2 switch. ALERT switchlight flashes, and NO DUAL, NO ALIGN, NO GA and CMD DISC messages are displayed.

(7) Release TEST 2 switch. ALERT switchlight goes off, and all messages are removed from indicator.

(8) Turn off electrical power (Ref. 24-00-00).

B. AFCS Warning Indicator Functional Test

NOTE: This functional test insures proper operation of AP DISC warning as related to safety

WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-20-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A and B (Ref. 29-11-00).

(4) Verify that the following systems are on:

Aileron control system (Ref. 27-11-00)

Rudder control system (Ref. 27-21-00)

Horizontal stabilizer control system (Ref 27-41-00)

Trailing edge flap system (Ref. 27-51-00)

Spoiler and speedbrake control system (Ref. 27-61-00)

Air/Ground sensing system (Ref. 32-63-00)

Aural warning unit (Ref. 31-22-00)

Attitude reference system (Ref. 34-21-00)

(5) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

All circuit breakers on AVIONICS FLIGHT CONTROL SYSTEM strips (A1), (A2), (A5), (A6), (A7), (A8), (A20), (A23), (A24), (A25), and (A26)

26 VAC NAV EXCITATION

ALT ALERT-1 (K27)

ALT ALERT-2 (J21)

R On FE/SO overhead circuit breaker panel CB2, zone 215,
R verify that the following circuit breakers are closed:

R FLIGHT STATION MISC

R R AOA (F1)

R AFCS WARNING

R CAPT (K18)

R STICK SHAKE (F2)F/O (K19)

R On FE/SO aft circuit breaker panel CB3, zone 215,
R verify that IND LT - FLT CONT/ALT ALERT (G9) circuit
R breaker is closed.

(6) On CB1, open then close PITCH & ROLL (A6) and (A24) circuit breakers.

NOTE: Steps 3B(6) thru 3B (19) are the warning indicator test (7) On APFDS ENGAGE panel, set AP engage switch A to CWS.

(8) On CB1, open PITCH & ROLL (A24) circuit breaker.

(9) On CB2, open AFCS WARNING - F/O (K19) circuit breaker.

(10) On Capt control wheel, depress AP DISC pushbutton. AP engage switch A drops to OFF. The 2-second aural warning (wailer tone) is heard. On Capt AFCS WARNING indicator, AP DISC message is displayed, and the ALERT light flashes.

(11) On CB1, close A24 circuit breaker.

(12) On CB2, close K19 circuit breaker.

(13) Set AP engage switch B to CWS.

(14) On CB1, open PITCH & ROLL (A6) circuit breaker.

(15) On CB2, open AFCS WARNING - CAPT (K18) circuit breaker.

(16) On F/O control wheel, depress AP DISC pushbutton. AP engage switch B drops to OFF. The 2-second aural warning (wailer tone) is heard. On F/O AFCS WARNING indicator, AP DISC message is displayed, and the ALERT light flashes.

(17) On CB1, open PITCH & ROLL (A24) circuit breaker.

(18) On CB1, close A6 and A24 circuit breakers. On F/O AFCS WARNING indicator, AP DISC message is removed when first circuit breaker is closed.

(19) On CB2, close K18 circuit breaker.

(20) On aural warning unit, hold AUTO PILOT TEST switch in position A for 5 seconds. There shall not be an audio tone from the aural warning unit.

NOTE: Steps 3B(20) thru 3B(22) are the aural warning unit test. An audio tone during this test indicates a fault

(21) Hold AUTO PILOT TEST switch in position B for 5 seconds. There shall not be an audio tone from the aural warning unit.

(22) Release AUTO PILOT TEST switch to neutral position.

(23) Turn off hydraulic power (Ref. 29-11-00).

(24) Turn off electrical power (Ref. 24-00-00).

FCES CONTROL PANEL - REMOVAL AND INSTALLATION

1. Referenced Procedures

   22-10-07 FCES Control Panel - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) Open and tag the following circuit breakers:

      On CB1: A1, A2, A5, A7, A20, A23, A25, B4, B5, B6

      On CB2: F1, K18, K19

R   on CB3: G9

      (2) Support FCES control panel located on pilots overhead panel, zone 210, and release fasteners on panel.

      (3) Lower panel sufficiently to disconnect electrical connectors, and remove panel.

   B. Installation

      (1) Verify that circuit breakers opened in Step A(1) are open and tagged.

      (2) Connect electrical connectors to FCES control panel.

      (3) Insert panel in position and secure.

      (4) Remove tags and close circuit breakers opened in Step A(1).

R   (5) Perform FCES control panel adjustment and test (Ref.
R   22-10-07).

FCES CONTROL PANEL - ADJUSTMENT AND TEST

1. Referenced Procedures

	21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
	24-00-00	Electrical Power - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices
	34-14-00	Central Air Data Computer System - Maintenance Practices
	34-21-00	Attitude Reference System - Maintenance Practices
R R	34-43-00	Inertial Navigation System - Maintenance Practices (on aircraft 025, 026, 028-999)
	34-32-00	Radio Altimeter System - Maintenance Practices

2. Functional Check

The FCES control panel functional test provided below requires that all other autoflight system components and associated equipment are installed and operational. The test is broken down into the following functions:

YAW SAS switchlight

STALL WARNING switchlight

DLC/AUTO SPLR switchlights

ATS switchlight

PITCH TRIM switchlights

MACH TRIM switchlights

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

(4) Verify that the following navigation systems are on:

Central air data computer system (Ref. 34-14-00)

Attitude reference system (Ref. 34-21-00)

R R Inertial Navigation System on Aircraft 025, 026, 028-999 (34-43-00)

Radio altimeter system (Ref. 34-32-00)

(5) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS

SPEED CONT (A2)

YAW SAS (A5)

TRIM AGMT - AC (A7)

TRIM AGMT - DC (A8)

FCES - COMPUTERS - DC (B4)

FCES - COMPUTERS - AC & L AOA (B5)

STICK SHAKE (B6)

NO. 2 SYSTEMS

SPEED CONT (A20)

YAW SAS (A23)

TRIM AGMT - AC (A25)

TRIM AGMT - DC (A26)

LANDING GEAR - PROX SW PWR - NO. 1 (L10)

LANDING GEAR - PROX SW PWR - NO. 4 (L11)

26 VAC NAV EXCITATION - SURFACE POS IND (J23)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

FLIGHT STATION MISC - R AOA (F1)

FLIGHT STATION MISC - STICK SHAKE (F2)

DLC SERVO - A (H14)

DLC SERVO - B (H15)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed:

PROXIMITY SWITCH - 2 (H3)

PROXIMITY SWITCH - 3 (H4)

IND LT - FLT CONT ALT ALERT (G9)

(6) On FCES control panel, release (out) all switchlights to off condition. Verify that all switchlights are indicating OFF.

B. YAW SAS Switchlight Test

(1) Depress YAW SAS 1 switchlight to on.

R WARNING: ENSURE THAT TRAVEL AREAS OF RUDDER AND AILERON SURFACES ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(2) Apply manual roll command on either control wheel. Verify that surface position indicator shows a rudder displacement.

(3) Depress YAW SAS 1 switchlight to OFF and YAW SAS 2 switchlight to on.

D. DLC/AUTO SPLR Switchlight Test

R (1) Depress DLC/AUTO SPLR 1 and 2 switchlights to on. On
R top of speedbrake lever, ensure speedbrake auto disable
R switch is in ON position (dual lights off).

WARNING: ENSURE THAT TRAVEL AREAS OF FLAP AND SPOILER SURFACES, AND AUTOTHROTTLE CLUTCH ASSEMBLY AREA ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(2) Set flaps to less than 30 degrees.

(3) Set any two engine power control levers to reverse-thrust position. Visual check to verify spoiler deployment. Also that surface position indicator shows ground spoiler deployment.

(4) Return flaps and engine power control levers to normal positions.

(5) On pilots overhead circuit breaker panel CB1, open AVIONICS FLIGHT CONTROL SYSTEM - FCES - COMPUTERS - AC & L AOA (B5) circuit breaker.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, FLIGHT STATION MISC - R AOA (F1) circuit breaker.

Verify that both DLC/AUTO SPLR switchlights and STALL WARN switchlights indicate FAIL.

(6) Close circuit breakers opened in Step D(5).

(7) Reset DLC/AUTO SPLR and STALL WARN switchlights to on.

E. ATS Switchlight Test

(1) Depress ATS 1 and 2 switchlights to on.

(2) On pilots overhead circuit breaker panel CB1, open AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 - SYSTEMS - SPEED CONT (A2) circuit breaker. Verify that both ATS switchlights indicate FAIL.

(3) Depress both ATS switchlights to turn off FAIL legends, and turn on OFF legends.

(4) Close circuit breakers opened in Step E(2).

(5) Reset ATS 1 and 2 switchlights to on.

F. PITCH TRIM Switchlight Test

(1) Depress PITCH TRIM 1 switchlight to on.

(2) On either control wheel, turn manual electrical pitch trim wheel. Verify a small control column displacement.

(3) Depress PITCH TRIM 1 switchlight to OFF and PITCH TRIM 2 switchlight to on.

(4) On either control wheel, turn manual electrical pitch trim wheel. Verify a small control column displacement.

(5) Depress PITCH TRIM 1 switchlight to on.

(6) On pilots overhead circuit breaker panel C81, open AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - TRIM AGMT - AC (A7) and AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - TRIM AGMT - AC (A25) circuit breakers. Verify that both PITCH TRIM switchlights indicate FAIL.

(7) Close circuit breakers opened in Step F(6).

(8) Reset PITCH TRIM 1 and 2 switchlights to on.

G. MACH TRIM Switchlight Test

(1) Depress MACH TRIM 1 and 2 switchlights to on.

R (2) On air data computer (ADC) No. 1 (Ref. 34-14-00),
R depress and hold (if analog ADC) or depress one second
R and release (if digital ADC) TEST switch. MACH TRIM 1
R switchlight indicates FAIL.

R (3) On ADC No. 2, depress and hold (if analog ADC) or
R depress one second and release (if digital ADC) TEST
R switch. MACH TRIM 2 switchlight indicates FAIL.

(4) Reset MACH TRIM 1 and 2 switchlight to on.

H. Test Completion

(1) In FESC, center rack, set LRS computer BITE switch to RESET for 5 seconds then return to RUN. Verify that CADC fail indicator on LRS computer has reset (BLACK).

(2) Turn off hydraulic power (Ref. 29-11-00).

(3) Turn off electrical power (Ref. 24-00-00).

FLIGHT CONTROL PANEL - REMOVAL AND INSTALLATION

1. Referenced Procedures

22-10-09 Flight Control Panel - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - TRIM AGMT - AC (A7)

NO. 2 SYSTEMS - TRIM AGMT - AC (A25)

On Flight Engineers/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following circuit breakers:

RUDDER SERVO - A (K12)

RUDDER SERVO - B (K13)

RUDDER SERVO - C (K14)

R On aircraft 001-017,
R RUDDER MECH LMTR - A (K15)

R On aircraft 001-017,
R RUDDER MECH LMTR - B (K16)

(2) Support flight control panel located on pilots overhead panel, zone 210, and release fasteners on panel.

(3) Lower panel sufficiently to disconnect electrical connector from rear of panel, and remove panel.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Connect electrical connector to flight control panel.

(3) Insert panel in position and secure.

(4) Remove tags and close circuit breakers opened in Step A(1).

R R (5) Perform flight control panel adjustment and test (Ref. 22-10-09).

B. On aircraft 001-031,
Flight Control Panel MACH FEEL Functional Test

(1) On FCES Panel, release ATS 1 and 2, PITCH TRIM 1 and 2, and MACH TRIM 1 and 2 switchlights to OFF.

(2) On flight control panel, depress MACH FEEL 1 and 2 switchlights to OFF then to on (dark).

R (3) On aircraft 001-017,
R on CADC No. 1 and 2, depress SELF TEST switches
R simultaneously and hold until directed to release in
R step (5). The ±30° legend goes out, and the ±8° legend
R illuminates. When test altitude, airspeed and mach
R indications are obtained, and when systems No. 1 and 2
R fail flags are out of view; continue to next step.

R (3) On aircraft 018-031,
R on CADC No. 1 and 2, depress SELF TEST switches
R simultaneously and hold until directed to release in
R step (5). When test altitude, airspeed and MACH
R indications are obtained, and when systems No. 1 and 2
R fail flags are out of view; continue to next step.

(4) Walk MACH FEEL indicator to approximately 0.9 by depressing MACH FEEL 1 and 2 switchlights to OFF, when they FAIL and then back on until no faults occur. Note that MACH FEEL indicator is operational.

R (5) On aircraft 001-017,
R release CADC No. 1 and 2 SELF TEST switches. The ±8°
R legend goes out, and the ±30° legend illuminates. When
R altitude, airspeed and MACH indications return to
R indications prior to step (3); continue to next step.

R (5) On aircraft 018-031,
R release CADC No. 1 and 2 SELF TEST switches. When
R altitude, airspeed and MACH indications return to
R indications prior to step (3); continue to next step.

(6) Walk MACH FEEL indicator down to minimum MACH indication by depressing MACH FEEL 1 and 2 switchlights to OFF, when they FAIL and then back on until no failures occur. Note that the MACH FEEL indicator returns to its original position.

B. On aircraft 032-999,
Flight Control Panel MACH FEEL Functional Test

(1) On FCES Panel, depress ATS 1 and 2, MACH TRIM 1 and 2 switchlights to OFF.

(2) On flight control panel, depress MACH FEEL 1 and 2 switchlights to OFF.

(3) Depress MACH FEEL switchlights to on.

(4) On both digital air data computers (DADC), simultaneously depress PUSH TO TEST switches for 1 second and release. When all air data instrument flags come in-view, verify that MACH FEEL 1 and 2 switchlights indicate FAIL and that HYDRAULIC PUSH switchlight is on.

(5) When the TEST IN PROGRESS lights start to flash (approx. 10 seconds after start of self test), simultaneously depress PUSH TO TEST switches for 1 second and release.

(6) Depress MACH FEEL 1 and 2 switchlights to OFF, then to on.

NOTE: The MACH FEEL switchlights may be reset to dark condition after FAIL during this portion of the test with no adverse effect.

(7) On flight control panel, verify that MACH FEEL meter pointer slews up to approximately 0.9 and then down to its original position.

C. Flight Control Panel RUDDER LIMITER Functional Test

R (1) On aircraft 001-017,
R on flight control panel, verify that each of the five
R switchlights is depressed and the ±30° legend is
R illuminated.

R (1) On aircraft 018-031,
R on flight control panel, verify that each of the three
R switchlights is illuminated.

(2) Ensure that flaps are set to zero degrees.

(3) On aircraft 001-017,
on flight control panel, release left MECHANICAL switchlight. Verify MNL legend appears and on right MECHANICAL switchlight ±30° legend is illuminated.

(4) On aircraft 001-017,
release right MECHANICAL switchlight. Verify that the ±30° legend goes out, and the ±8° legend illuminates.

(5) On aircraft 001-017,
depress left MECHANICAL switchlight. Verify MNL legend

goes out, and ±8° legend goes out, and ±30° legend is illuminated.

(6) On PFCS monitor/control panel, depress RUDDER switchlight to OFF. On flight control panel, verify that HYDRAULIC switchlight indicates PUSH.

(7) Release HYDRAULIC switchlight. Verify that OVRD legend illuminates and PUSH legend goes out.

(8) On PFCS monitor/control panel, depress RUDDER switchlight. RUDDER OFF legend goes out.

(9) Depress HYDRAULIC switchlight. Verify OVRD legend goes out.

(10) On aircraft 001-017, depress right MECHANICAL switchlight.

(11) On aircraft 001-017, on CADC No. 1, depress SELF TEST switch until MECHANICAL switchlight PUSH legend illuminates, then release SELF TEST switch. PUSH legend comes on when airspeed is above approximately 164 knots and goes out when airspeed goes below approximately 164 knots. Disregard MACH FEEL fail, and reset MACH FEEL switchlights.

D. Test Completion

(1) Close circuit breakers opened in Step 2A(7).

(2) Reset switchlights opened in Step 2B(1).

(3) Turn off hydraulic power (Ref. 29-11-00).

(4) Turn off electrical power (Ref. 24-00-00).

FLIGHT CONTROL PANEL - ADJUSTMENT AND TEST

1. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-00	Ram Air Turbine - Maintenance Practices
34-14-00	Central Air Data Computer System - Maintenance Practices

2. Adjustment/Test

The flight control panel functional test provided requires that all other autoflight system components and associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

(4) Verify that central air data computer system is on (Ref. 34-14-00).

(5) Set flaps to zero degrees.

(6) On pilots overhead circuit breaker panel CB1, zone 213, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS AND NO. 2 SYSTEMS

TRIM AGMT - AC (A7) (A25)

TRIM AGMT - DC (A8) (A26)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 216, verify that the following circuit breakers are closed:

STABILIZER SERVO

LB (H15)

RC (H16)

LA (H17)

RD (H18)

RUDDER SERVO

A (K12)

B (K13)

C (K14)

R On aircraft 001-017,
RUDDER MECH LMTR

A (K15)

B (K16)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 216, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

(7) On CB1, open and tag the following circuit breakers:

MISC - RAT AUTO DEPLOY (L3)

AURAL WARN MULT SND (L7)

(8) Install RAT ground safety lock (Ref. 29-21-00).

B. On aircraft 001-031,
Flight Control Panel MACH FEEL Functional Test

(1) On FCES Panel, release ATS 1 and 2, PITCH TRIM 1 and 2, and MACH TRIM 1 and 2 switchlights to OFF.

(2) On flight control panel, depress MACH FEEL 1 and 2 switchlights to OFF then to on (dark).

(3) On CADC No. 1 and 2, depress SELF TEST switches simultaneously and hold until directed to release in step (5). The ±30° legend goes out, and the ±8° legend illuminates. When test altitude, airspeed and mach indications are obtained, and when systems No. 1 and 2 fail flags are out of view; continue to next step.

(4) Walk MACH FEEL indicator to approximately 0.9 by depressing MACH FEEL 1 and 2 switchlights to OFF, when they FAIL and then back on until no faults occur. Note that MACH FEEL indicator is operational.

(5) Release CADC No. 1 and 2 SELF TEST switches. The ±8° legend goes out, and the ±30° legend illuminates. When altitude, airspeed and MACH indications return to indications prior to step (3); continue to next step.

(6) Walk MACH FEEL indicator down to minimum MACH indication by depressing MACH FEEL 1 and 2 switchlights to OFF, when they FAIL and then back on until no failures occur. Note that the MACH FEEL indicator returns to its original position.

B. On aircraft 032-999,
Flight Control Panel MACH FEEL Functional Test

(1) On FCES Panel, depress ATS 1 and 2, MACH TRIM 1 and 2 switchlights to OFF.

(2) On flight control panel, depress MACH FEEL 1 and 2 switchlights to OFF.

(3) Depress MACH FEEL switchlights to on.

(4) On both digital air data computers (DADC), simultaneously depress PUSH TO TEST switches for 1 second and release. When all air data instrument flags come in-view, verify that MACH FEEL 1 and 2 switchlights indicate FAIL and that HYDRAULIC PUSH switchlight is on.

(5) When the TEST IN PROGRESS lights start to flash (approx. 10 seconds after start of self test),

simultaneously depress PUSH TO TEST switches for 1 second and release.

(6) Depress MACH FEEL 1 and 2 switchlights to OFF, then to on.

NOTE: The MACH FEEL switchlights may be reset to dark condition after FAIL during this portion of the test with no adverse effect.

(7) On flight control panel, verify that MACH FEEL meter pointer slews up to approximately 0.9 and then down to its original position.

C. Flight Control Panel RUDDER LIMITER Functional Test

(1) On aircraft 001-017, onflight control panel, verify that each of the five switchlights is depressed and the ±30° legend is illuminated.

(1) On aircraft 018-999,
R on flight control panel, verify that each of the three
R switchlights is illuminated.

(2) Ensure that flaps are set to zero degrees.

(3) On aircraft 001-017, on flight control panel, release left MECHANICAL switchlight. Verify MNL legend appears and on right MECHANICAL switchlight ±30° legend is illuminated.

(4) On aircraft 001-017, release right MECHANICAL switchlight. Verify that the ±30° legend goes out, and the ±8° legend illuminates.

(5) On aircraft 001-017, depress left MECHANICAL switchlight. Verify MNL legend goes out, and ±8° legend goes out, and ±30° legend is illuminated.

(6) On PFCS monitor/control panel, depress RUDDER switchlight to OFF. On flight control panel, verify that HYDRAULIC switchlight indicates PUSH.

(7) Release HYDRAULIC switchlight. Verify that OVRD legend illuminates and PUSH legend goes out.

(8) On PFCS monitor/control panel, depress RUDDER switchlight. RUDDER OFF legend goes out.

(9) Depress HYDRAULIC switchlight. Verify OVRD legend goes out.

R (10) On aircraft 001-017, depress right MECHANICAL switchlight.

R (11) On aircraft 001-017, on CADC No. 1, depress SELF TEST switch until MECHANICAL switchlight PUSH legend illuminates, then release SELF TEST switch. PUSH legend comes on when airspeed is above approximately 164 knots and goes out when airspeed goes below approximately 164 knots. Disregard MACH FEEL fail, and reset MACH FEEL switchlights.

D. Test Completion

(1) Close circuit breakers opened in Step 2A(7).

(2) Reset switchlights opened in Step 2B(1).

(3) Turn off hydraulic power (Ref. 29-11-00).

(4) Turn off electrical power (Ref. 24-00-00).

AFCS/MLG ACCESSORY UNIT - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting AFCS/MLG accessory unit faults are included in this section of the manual. An AFCS/MLG accessory unit malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a block number indicating the diagram entry point containing the fault isolation procedure. When no block number is specified, perform fault isolation in Paragraph 4.

Schematic diagrams, indentified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Equipment and Materials

AC/DC Voltmeter - Range 0.01 - 100 volts.

R Breakout Cable Assembly for AFCS/MLG Accessory Unit, G/ITEL No. 22-00-20 (See Figure 509, 22-12-37). (One Req.).

3. Referenced Procedures

7-11-00	Wing and Fuselage Jacking - Maintenance Practices
21-25-00	Electronics and Electrical Service Centers Exhaust Systems - Adjustment and Test
22-12-37	DUAL A/L NOT AVAIL (DANA) - Fault Isolation
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practice

4. Fault Isolation Identification

Table 101 is a list of the AFCS/MLG accessory unit fault isolation diagrams and schematics. Figures 101 and 102 provide component location for AFCS/MLG accessory unit troubleshooting.

AFCS/MLG accessory unit fault isolation is broken down into operational problems encountered during normal flight operation and ground testing (See Table 102). Figure 103 in conjunction with Figure 104 is used to detect any obvious AFCS/MLG accessory unit faults which would result in a TO/GA fault, or a AUTO GND SPLR INOP light. Figure 104 is a list of the AFCS/MLG accessory unit output voltages measured using a signal intercept cable (T-cable).

AFCS/MLG accessory unit fault isolation is performed using the procedure detailed in Figure 103 and monitoring voltages using T-cables. For fault isolating aircraft wiring, use SCHEM 1. Table 102 is a summary of faults caused by a defective AFCS/MLG accessory unit. The preparation in Step A must be satisfied prior to starting the fault isolation in Figure 101.

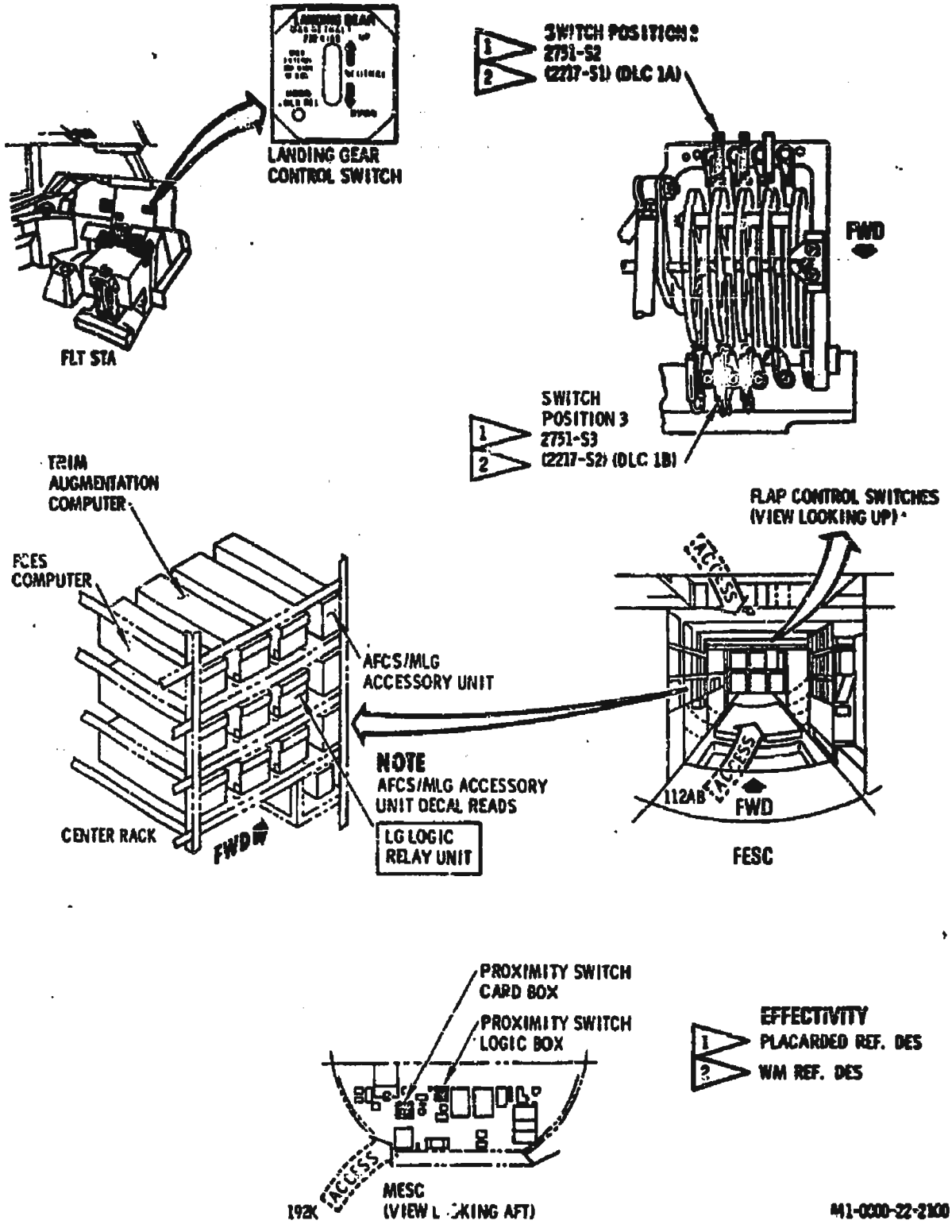
Fault Isolation Diagrams and Schematics List
TABLE 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
TABLE 102	Summary of Faults Caused By The AFCS/MLG Accessory Unit
103	Trouble Shooting AFCS/MLG Accessory Unit Using T-Cable
104	AFCS/MLG Accessory Unit T-Cable Voltage Measurements
SCHEM 1	AFCS/MLG Accessory Unit Interface Schematic

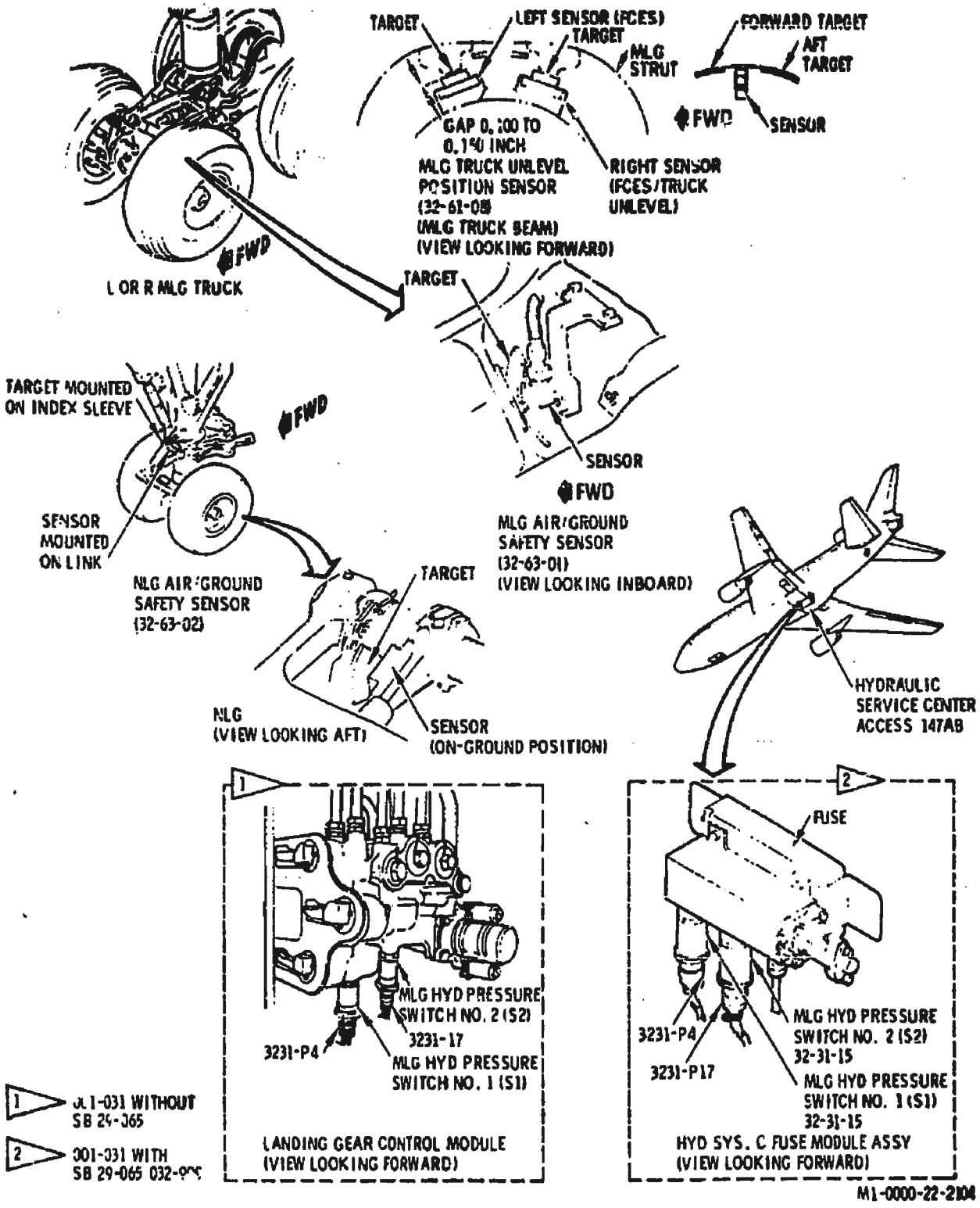
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCESSORY UNIT – AFCS/MLG	1	FESC, CTR RACK/112AB	22-10-11
BOX – PROXIMITY SWITCH CARDS J8, J13, J28	1	MESC/102K	31-22-01
BOX – PROXIMITY SWITCH LOGIC CARDS J3, J5, J11	1	MESC/102K	31-22-02
COMPUTER – FCES	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER – TRIM AUGMENTATION	1	FESC, CTR RACK/112AB	22-18-01
SENSOR – MLG AIR/GROUND SAFETY	2	MLG	32-63-01
SENSOR – MLG TRUCK UNLEVEL POSITION	4	MLG	32-61-68
SENSOR – NLG AIR/GROUND SAFETY	1	NLG	32-63-02
SWITCH – FLAP CONTROL	2	FESC, FWD RIGHT OVHD/112AB	27-51-65
SWITCH – LANDING GEAR CONTROL	1	FLT STA, CTR INSTR PNL	32-31-14
SWITCH – MLG HYDRAULIC PRESSURE	2	HCS/147AB	32-31-15

M1-0000-22-2066

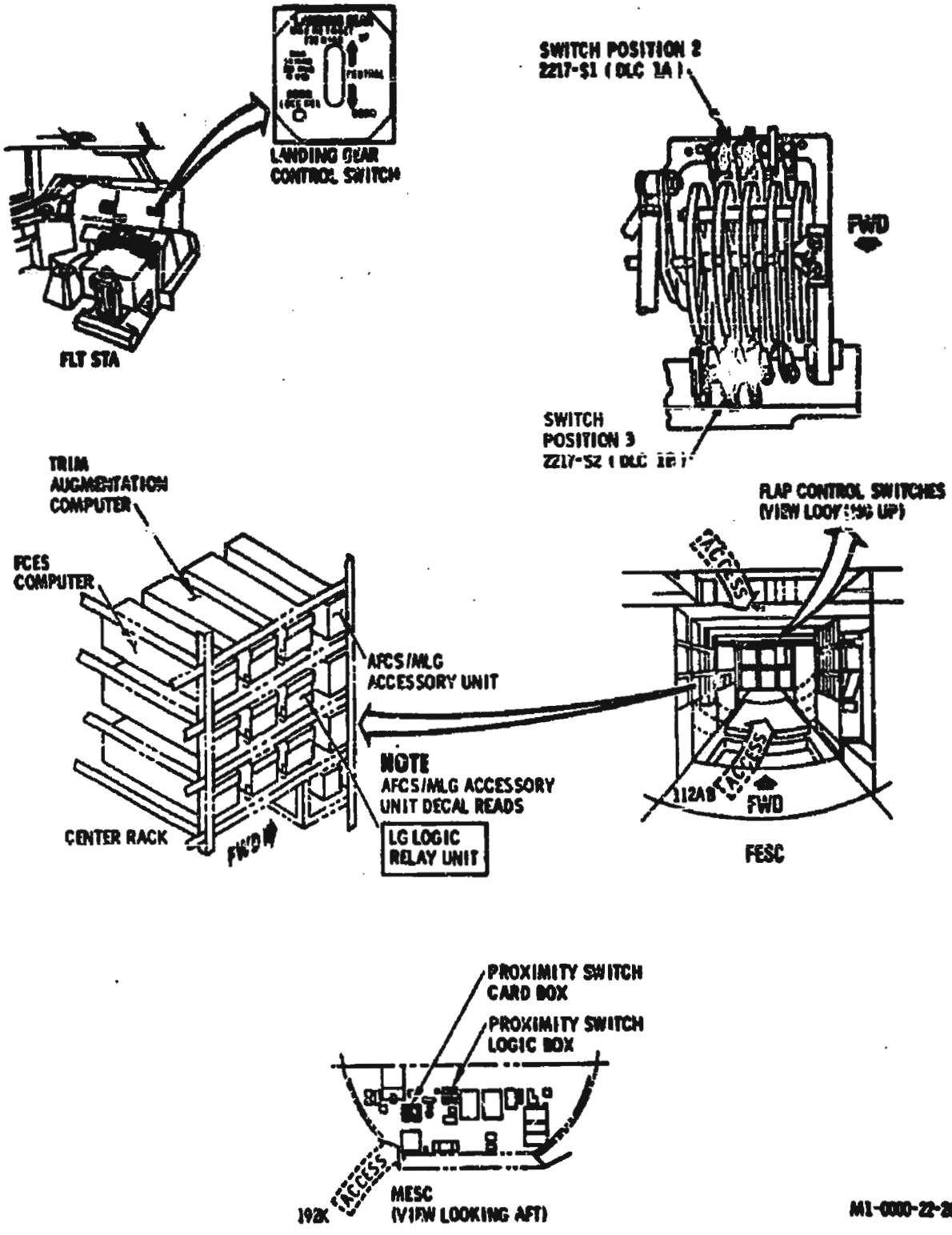
Component Location Index
Figure 101



Component Locator Diagram
Figure 102 (Sheet 1)

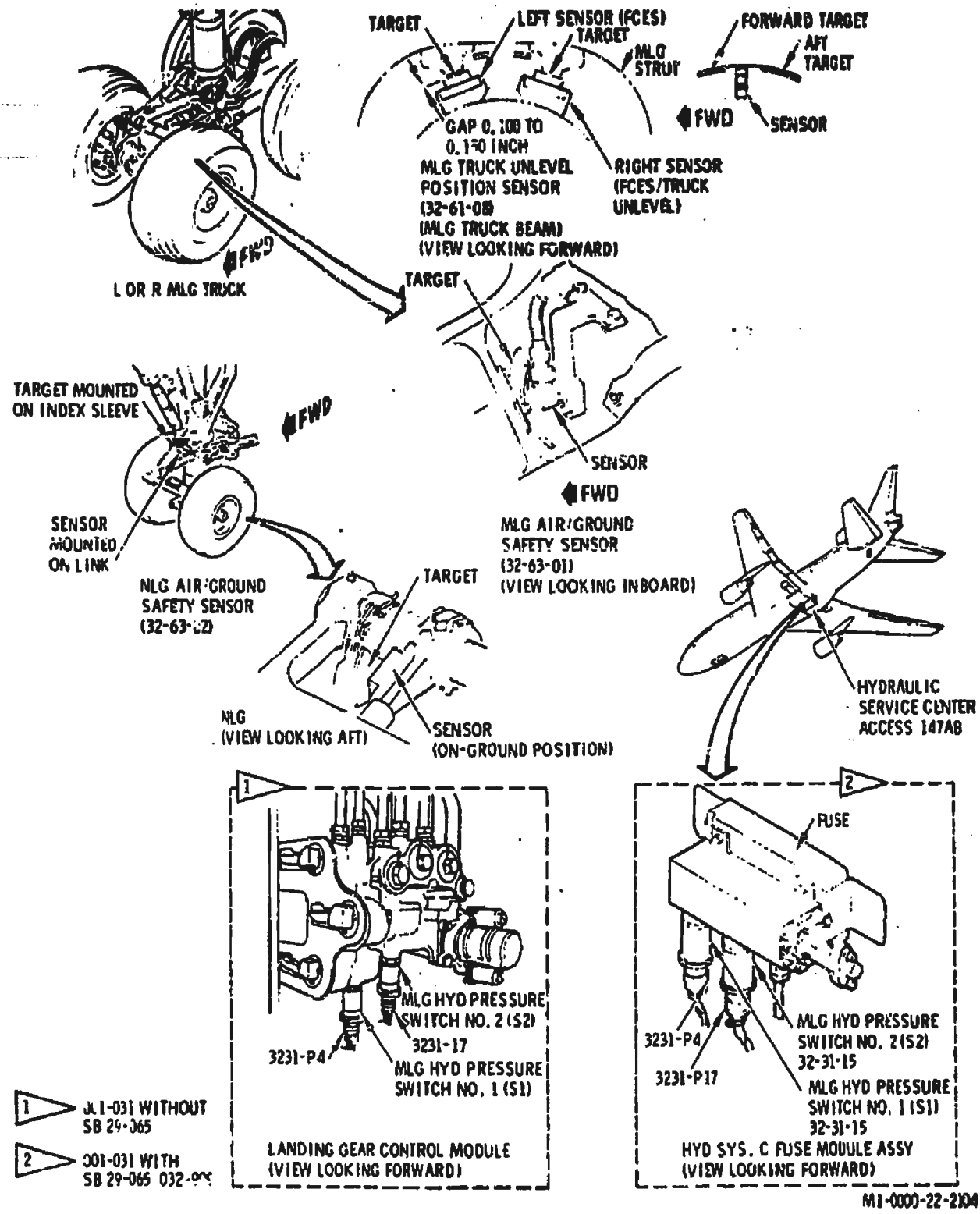


Component Locator Diagram
Figure 102 (Sheet 2)



M1-0000-22-2613

Component Locator Diagram
Figure 102 (Sheet 1)



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Component Locator Diagram
Figure 102 (Sheet 2)

R Summary of Faults Caused By The AFCS/MLG Accessory Unit
Table 102

COMMON FAULTS
• ADC FIM not inhibited on FCES computer by trim augmentation computer logic during ground testing of ADC system.
• Control wheel creep (Roll) on ground; with HDG mode engaged, heading selected 15 degrees greater than aircrafts, and one autopilot engaged in CMD mode.
• GO AROUND message displayed when TAKEOFF mode is engaged on the ground.
• AUTO GND SPLRS INOP light remains on when one or both DLC/AUTO SPLRS 1 and 2 switchlights are turned on (dark).
• Stick shaker inoperative when STALL WARN TEST switch is depressed on the ground.

A. Preparation

(1) On APFDS ENGAGE panel, ensure that AP A and B switches, and FD A and B switches are set to OFF.

(2) Turn on electrical power (Ref. 24-00-00).

(3) Verify that avionics cooling is on (Ref. 21-25-00).

(4) On pilots overhead circuit breaker panel CB1, open the following circuit breakers:

NO. 1 and 2 SYSTEMS PITCH & ROLL (A6, A24)

NO. 2 SYSTEMS TRIM AGMT AC (A25)

FCES CMPTR AC & LAOA (B5)

On FE/SO overhead circuit breaker panel CB2, open the following circuit breakers:

FLIGHT STATION MISC R-AOA (F1)

GEAR TRUCK LEVEL (F16)

MLG GND SENSE (L8)

(5) Remove AFCS/MLG accessory unit and reinstall with T-cable (G/ITEL No.22-00-20).

(6) Close circuit breakers opened in Step (4).

(7) On FCES panel, depress STALL WARN 1 and 2 to on (dark), and depress DLC/AUTO SPLR 1 and 2 to OFF.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN REAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

THE HORIZONTAL STABILIZER WILL ALWAYS RETURN TO THE +1 DEGREE POSITION (AGAINST ACTUATOR STOPS) INDEPENDENT OF THE POSITION OF THE COLUMNS WHENEVER ALL HYDRAULIC SYSTEMS ARE OFF. THEREFORE, AFTER ALL TESTS, THE CONTROL COLUMNS SHALL BE POSITIONED TO OBTAIN A +1 DEGREE READING ON THE SURFACE POSITION INDICATOR (SPI) BEFORE SHUTTING DOWN THE HYDRAULIC SYSTEMS.

DURING PERFORMANCE OF FOLLOWING TESTS, THE PILOTS CONTROL COLUMN AND WHEELS WILL MOVE. STAY CLEAR OF THESE CONTROLS AT ALL TIMES.

(8) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

(9) Set flaps to zero degrees.

(10) Set throttle levers (3) to greater than TO/GA position.

B. Trouble Shooting

(1) Perform fault isolation of AFCS/MLG accessory unit as described in Figure 103

C. Completion

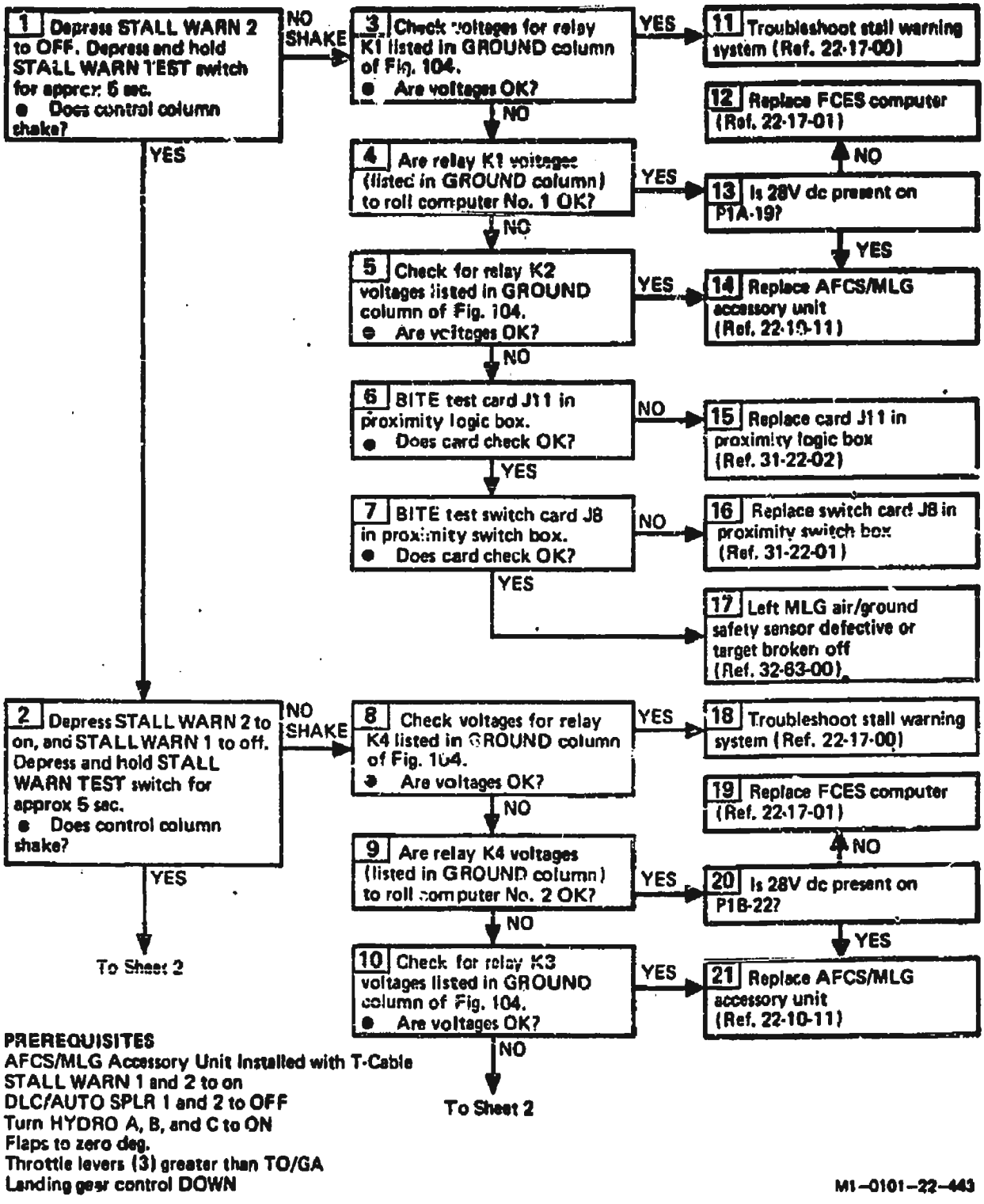
(1) Make certain that T-cable is removed and AFCS/MLG accessory unit is securely mounted in rack.

(2) Set flaps to zero degrees.

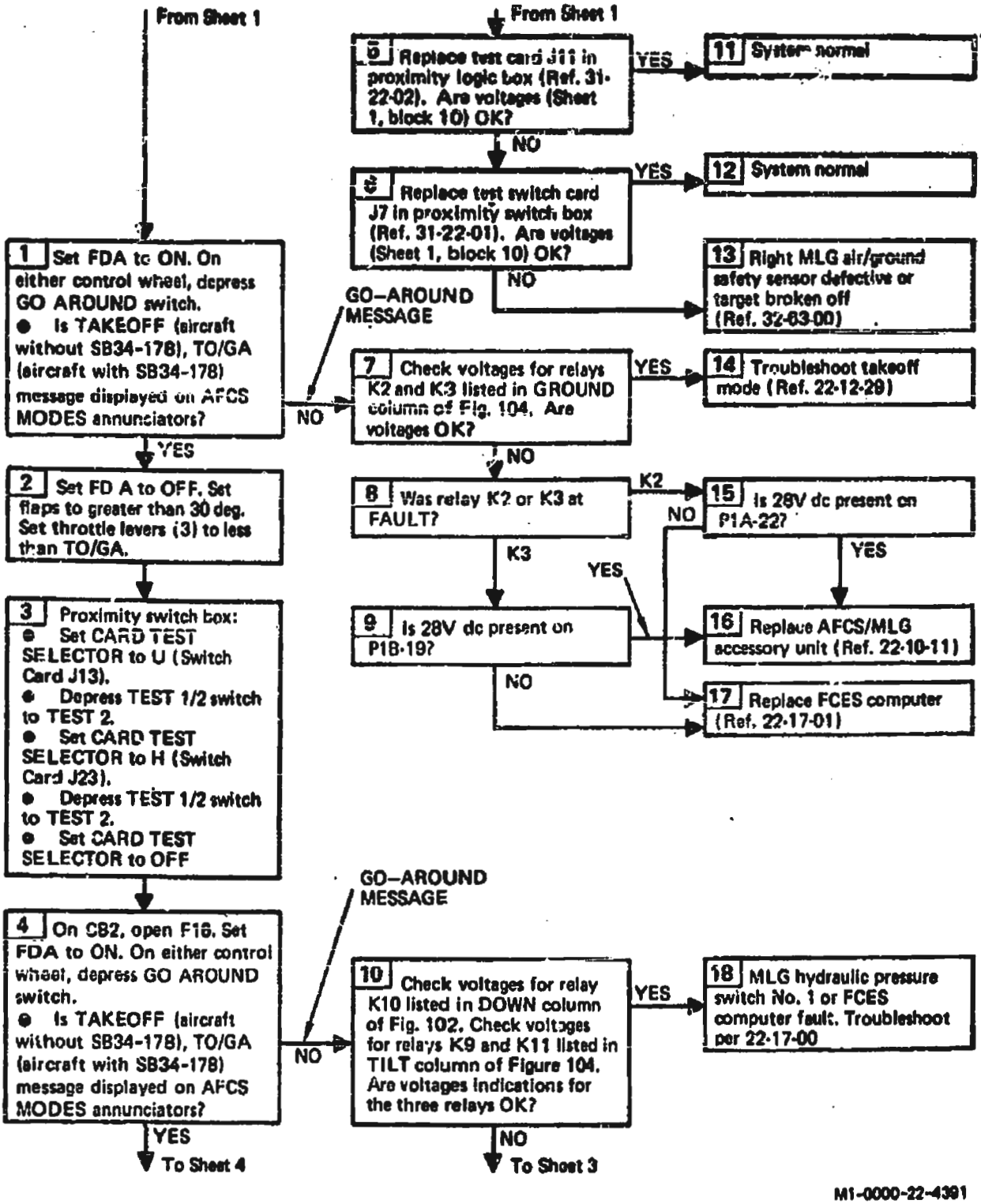
(3) On FCES computer, depress RESET pushbutton to reset FIM indications.

(4) Turn off hydraulic power (Ref. 29-11-00).

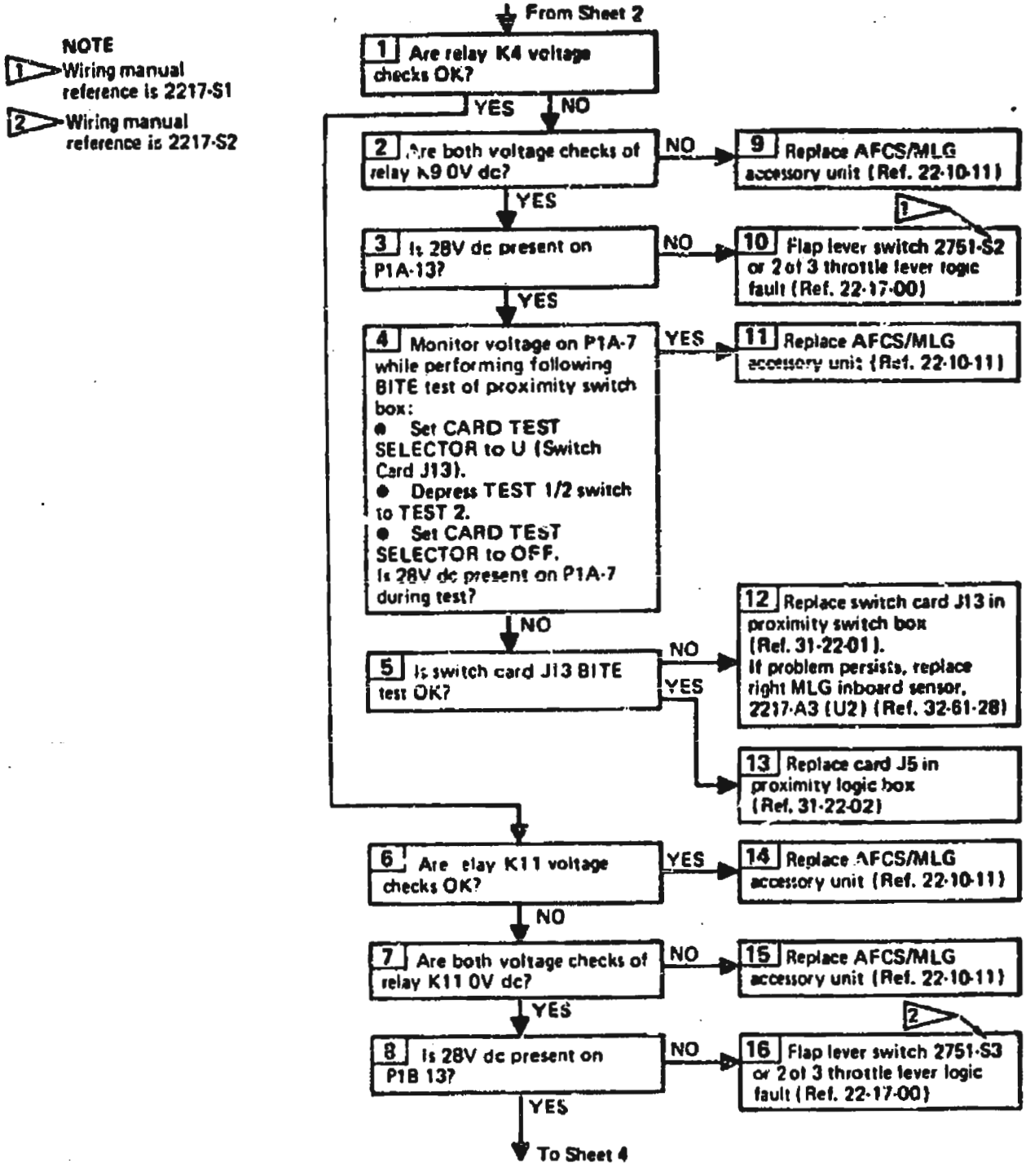
(5) Turn off electrical power (Ref. 24-00-00).


1 Depress STALL WARN 2 to OFF. Depress and hold STALL WARN TEST switch for apprcr. 6 sec.
● Does control column shake?
NO SHAKE
YES
2 Depress STALL WARN 2 to on, and STALL WARN 1 to off. Depress and hold STALL WARN TEST switch for approx 5 sec.
● Does control column shake?
NO SHAKE
YES
To Sheet 2
3 Check voltages for relay K1 listed in GROUND column of Fig. 104.
● Are voltages OK?
YES
NO
4 Are relay K1 voltages (listed in GROUND column) to roll computer No. 1 OK?
YES
NO
5 Check for relay K2 voltages listed in GROUND column of Fig. 104.
● Are voltages OK?
YES
NO
6 BITE test card J11 in proximity logic box.
● Does card check OK?
NO
YES
7 BITE test switch card J8 in proximity switch box.
● Does card check OK?
NO
YES
8 Check voltages for relay K4 listed in GROUND column of Fig. 104.
● Are voltages OK?
YES
NO
9 Are relay K4 voltages (listed in GROUND column) to roll computer No. 2 OK?
YES
NO
10 Check for relay K3 voltages listed in GROUND column of Fig. 104.
● Are voltages OK?
YES
NO
To Sheet 2
11 Troubleshoot stall warning system (Ref. 22-17-00)
12 Replace FCES computer (Ref. 22-17-01)
NO
13 Is 28V dc present on P1A-19?
YES
14 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
15 Replace card J11 in proximity logic box (Ref. 31-22-02)
16 Replace switch card J8 in proximity switch box (Ref. 31-22-01)
17 Left MLG air/ground safety sensor defective or target broken off (Ref. 32-63-00)
18 Troubleshoot stall warning system (Ref. 22-17-00)
19 Replace FCES computer (Ref. 22-17-01)
NO
20 Is 28V dc present on P1B-22?
YES
21 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
PREREQUISITES
AFCS/MLG Accessory Unit Installed with T-Cable
STALL WARN 1 and 2 to on
DLC/AUTO SPLR 1 and 2 to OFF
Turn HYDRO A, B, and C to ON
Flaps to zero deg.
Throttle levers (3) greater than TO/GA
Landing gear control DOWN
M1-0101-22-443

Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
Figure 103 (Sheet 1)

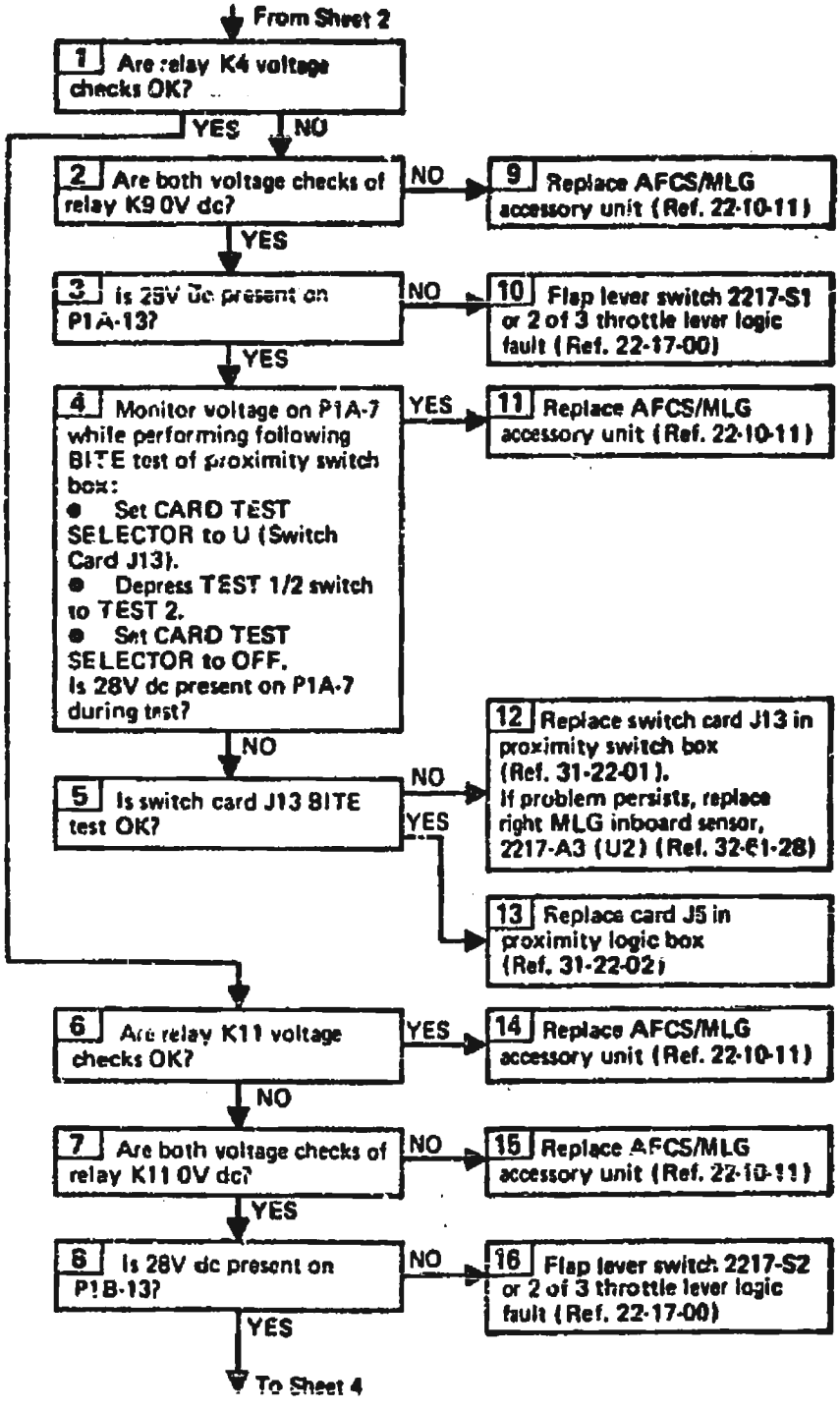

From Sheet 1
From Sheet 1
1 Set FDA to ON. On either control wheel, depress GO AROUND switch.
● Is TAKEOFF (aircraft without SB34-178), TO/GA (aircraft with SB34-178) message displayed on AFCS MODES annunciators?
YES
NO
2 Set FD A to OFF. Set flaps to greater than 30 deg. Set throttle levers (3) to less than TO/GA.
3 Proximity switch box:
● Set CARD TEST SELECTOR to U (Switch Card J13).
● Depress TEST 1/2 switch to TEST 2.
● Set CARD TEST SELECTOR to H (Switch Card J23).
● Depress TEST 1/2 switch to TEST 2.
● Set CARD TEST SELECTOR to OFF
4 On CB2, open F16. Set FDA to ON. On either control wheel, depress GO AROUND switch.
● Is TAKEOFF (aircraft without SB34-178), TO/GA (aircraft with SB34-178) message displayed on AFCS MODES annunciators?
YES
To Sheet 4
NO
GO–AROUND MESSAGE
5 Replace test card J11 in proximity logic box (Ref. 31-22-02). Are voltages (Sheet 1, block 10) OK?
YES
11 System normal
NO
6 Replace test switch card J7 in proximity switch box (Ref. 31-22-01). Are voltages (Sheet 1, block 10) OK?
YES
12 System normal
NO
13 Right MLG air/ground safety sensor defective or target broken off (Ref. 32-63-00)
GO–AROUND MESSAGE
7 Check voltages for relays K2 and K3 listed in GROUND column of Fig. 104. Are voltages OK?
YES
14 Troubleshoot takeoff mode (Ref. 22-12-29)
NO
8 Was relay K2 or K3 at FAULT?
K2
15 Is 28V dc present on P1A-22?
NO
YES
K3
9 Is 28V dc present on P1B-19?
YES
16 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
17 Replace FCES computer (Ref. 22-17-01)
GO–AROUND MESSAGE
10 Check voltages for relay K10 listed in DOWN column of Fig. 102. Check voltages for relays K9 and K11 listed in TILT column of Figure 104. Are voltages indications for the three relays OK?
YES
18 MLG hydraulic pressure switch No. 1 or FCES computer fault. Troubleshoot per 22-17-00
NO
To Sheet 3
M1-0000-22-4391

R Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
R Figure 103 (Sheet 2)


NOTE
1 Wiring manual reference is 2217-S1
2 Wiring manual reference is 2217-S2
From Sheet 2
1 Are relay K4 voltage checks OK?
YES
NO
2 Are both voltage checks of relay K9 0V dc?
NO
9 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
3 Is 28V dc present on P1A-13?
NO
10 Flap lever switch 2751-S2 or 2 of 3 throttle lever logic fault (Ref. 22-17-00)
YES
4 Monitor voltage on P1A-7 while performing following BITE test of proximity switch box:
• Set CARD TEST SELECTOR to U (Switch Card J13).
• Depress TEST 1/2 switch to TEST 2.
• Set CARD TEST SELECTOR to OFF.
Is 28V dc present on P1A-7 during test?
YES
11 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
5 Is switch card J13 BITE test OK?
NO
12 Replace switch card J13 in proximity switch box (Ref. 31-22-01). If problem persists, replace right MLG inboard sensor, 2217-A3 (U2) (Ref. 32-61-28)
YES
13 Replace card J5 in proximity logic box (Ref. 31-22-02)
6 Are relay K11 voltage checks OK?
YES
14 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
7 Are both voltage checks of relay K11 0V dc?
NO
15 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
8 Is 28V dc present on P1B 13?
NO
16 Flap lever switch 2751-S3 or 2 of 3 throttle lever logic fault (Ref. 22-17-00)
YES
To Sheet 4

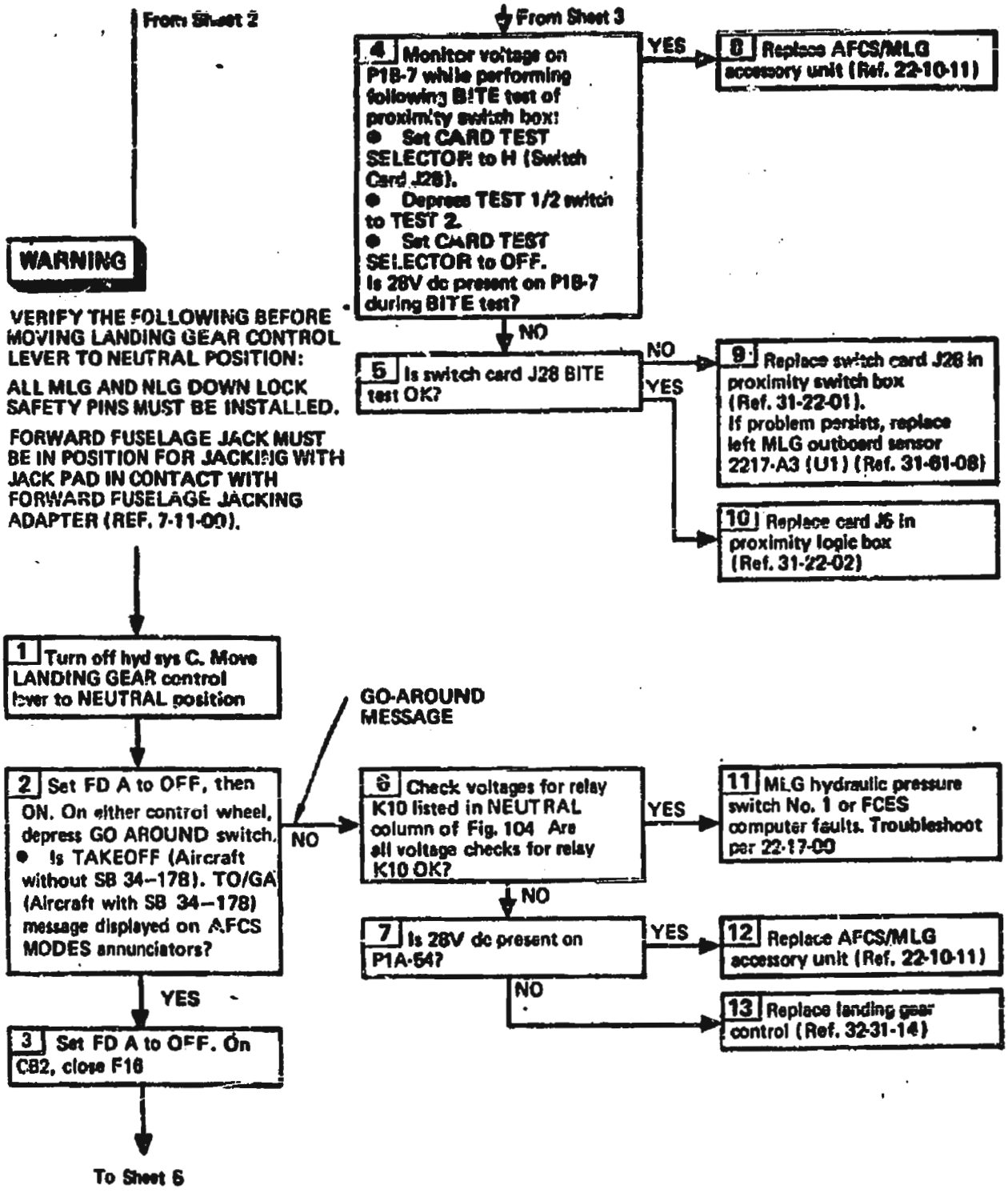
M1-0000-22-2615

R Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
R Figure 103 (Sheet 3)


From Sheet 2
1 Are relay K4 voltage checks OK?
YES
NO
2 Are both voltage checks of relay K9 0V dc?
NO
9 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
3 Is 28V dc present on P1A-13?
NO
10 Flap lever switch 2217-S1 or 2 of 3 throttle lever logic fault (Ref. 22-17-00)
YES
4 Monitor voltage on P1A-7 while performing following BITE test of proximity switch box:
• Set CARD TEST SELECTOR to U (Switch Card J13).
• Depress TEST 1/2 switch to TEST 2.
• Set CARD TEST SELECTOR to OFF.
Is 28V dc present on P1A-7 during test?
YES
11 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
5 Is switch card J13 BITE test OK?
NO
12 Replace switch card J13 in proximity switch box (Ref. 31-22-01). If problem persists, replace right MLG inboard sensor, 2217-A3 (U2) (Ref. 32-61-28)
YES
13 Replace card J5 in proximity logic box (Ref. 31-22-02)
6 Are relay K11 voltage checks OK?
YES
14 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
7 Are both voltage checks of relay K11 0V dc?
NO
15 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
8 Is 28V dc present on P1B-13?
NO
16 Flap lever switch 2217-S2 or 2 of 3 throttle lever logic fault (Ref. 22-17-00)
YES
To Sheet 4

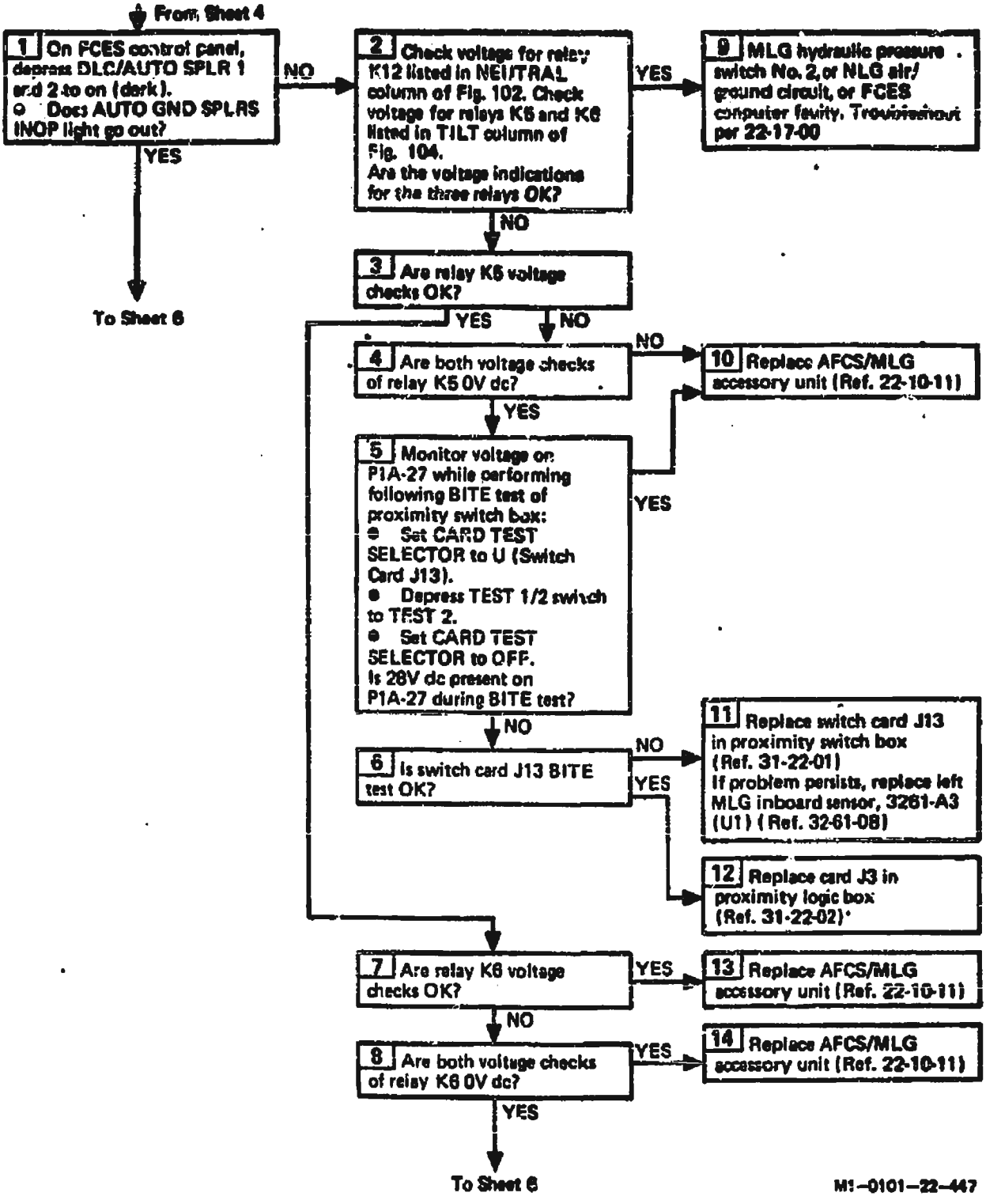
M1-0001-22-445

R Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
R Figure 103 (Sheet 3)

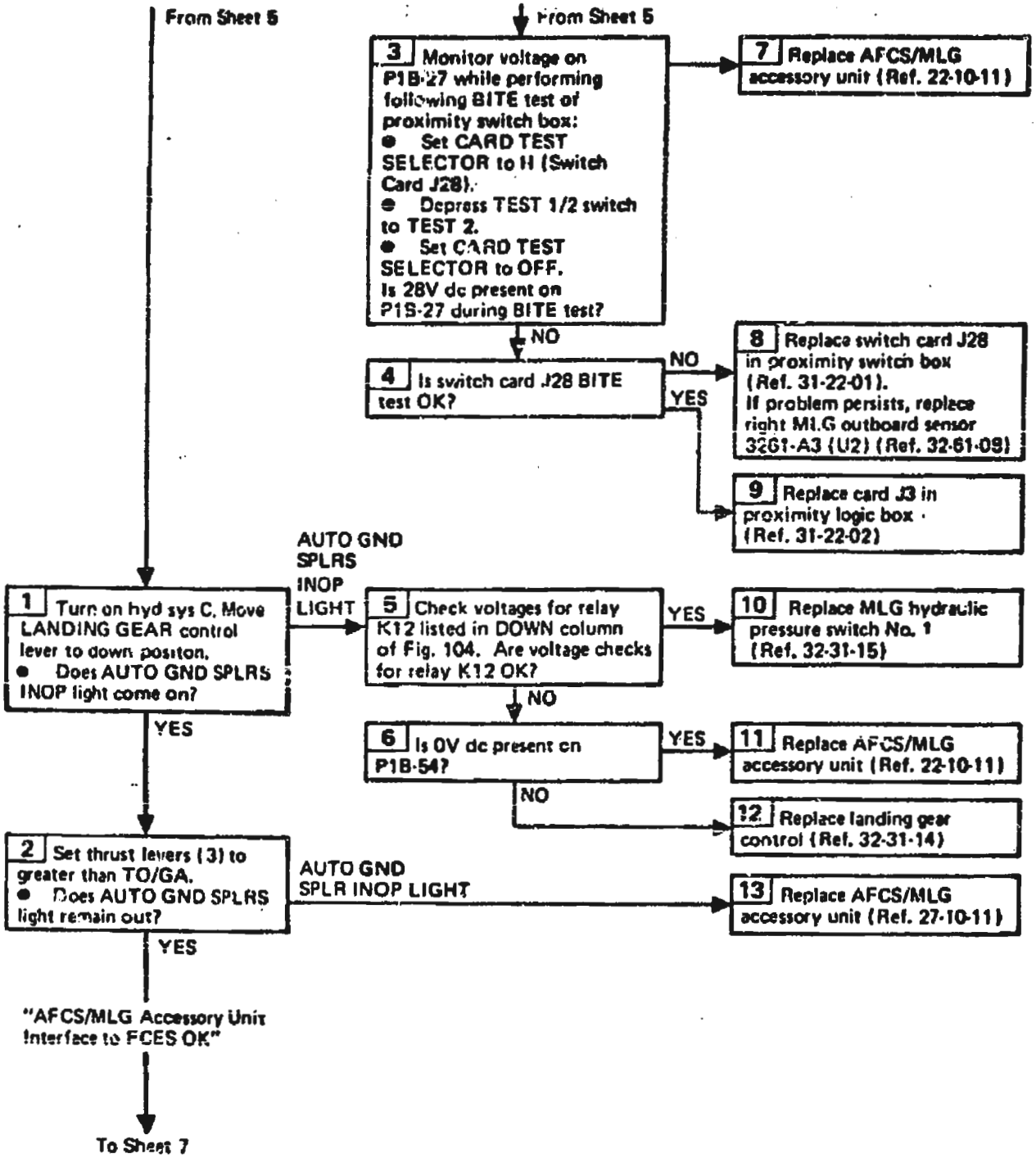

From Sheet 2
From Sheet 3
WARNING
VERIFY THE FOLLOWING BEFORE MOVING LANDING GEAR CONTROL LEVER TO NEUTRAL POSITION:
ALL MLG AND NLG DOWN LOCK SAFETY PINS MUST BE INSTALLED.
FORWARD FUSELAGE JACK MUST BE IN POSITION FOR JACKING WITH JACK PAD IN CONTACT WITH FORWARD FUSELAGE JACKING ADAPTER (REF. 7-11-00).
1 Turn off hyd sys C. Move LANDING GEAR control lever to NEUTRAL position
2 Set FD A to OFF, then ON. On either control wheel, depress GO AROUND switch.
• Is TAKEOFF (Aircraft without SB 34-178). TO/GA (Aircraft with SB 34-178) message displayed on AFCS MODES annunciators?
YES
NO
GO-AROUND MESSAGE
3 Set FD A to OFF. On C82, close F16
To Sheet 6
4 Monitor voltage on P1B-7 while performing following BITE test of proximity switch box:
• Set CARD TEST SELECTOR to H (Switch Card J28).
• Depress TEST 1/2 switch to TEST 2.
• Set CARD TEST SELECTOR to OFF.
Is 28V dc present on P1B-7 during BITE test?
YES
8 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
5 Is switch card J28 BITE test OK?
NO
9 Replace switch card J28 in proximity switch box (Ref. 31-22-01). If problem persists, replace left MLG outboard sensor 2217-A3 (U1) (Ref. 31-61-08)
YES
10 Replace card J6 in proximity logic box (Ref. 31-22-02)
6 Check voltages for relay K10 listed in NEUTRAL column of Fig. 104. Are all voltage checks for relay K10 OK?
YES
11 MLG hydraulic pressure switch No. 1 or FCES computer faults. Troubleshoot per 22-17-00
NO
7 Is 28V dc present on P1A-54?
YES
12 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
13 Replace landing gear control (Ref. 32-31-14)

M1-0000-22-4392

R Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
R Figure 103 (Sheet 4)

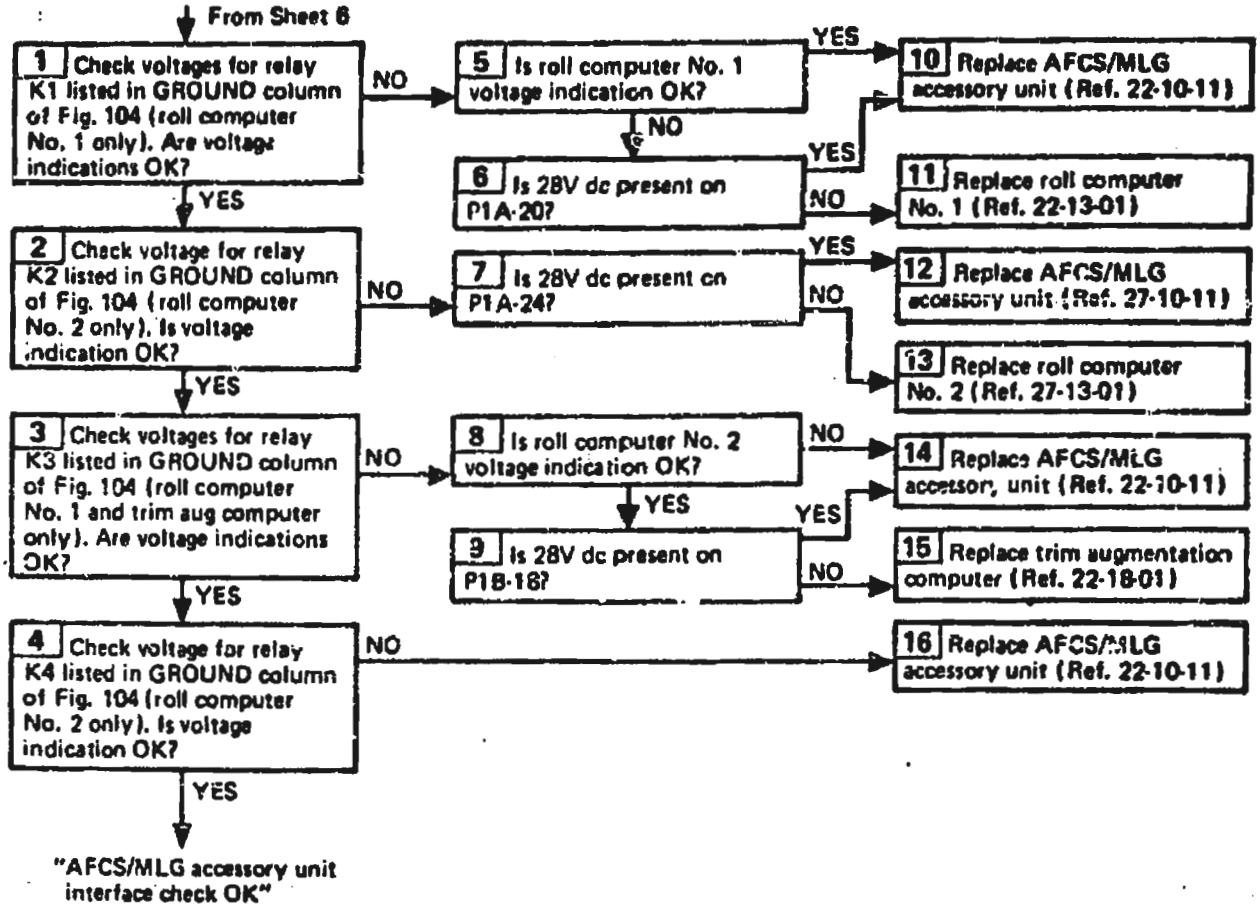

From Sheet 4
1 On FCES control panel, depress DLC/AUTO SPLR 1 and 2 to on (dark).
• Does AUTO GND SPLRS INOP light go out?
NO
YES
To Sheet 6
2 Check voltage for relay K12 listed in NEUTRAL column of Fig. 102. Check voltage for relays K5 and K6 listed in TILT column of Fig. 104.
Are the voltage indications for the three relays OK?
YES
9 MLG hydraulic pressure switch No. 2, or NLG air/ground circuit, or FCES computer faulty. Troubleshoot per 22-17-00
NO
3 Are relay K5 voltage checks OK?
YES
NO
4 Are both voltage checks of relay K5 0V dc?
NO
10 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
5 Monitor voltage on P1A-27 while performing following BITE test of proximity switch box:
• Set CARD TEST SELECTOR to U (Switch Card J13).
• Depress TEST 1/2 switch to TEST 2.
• Set CARD TEST SELECTOR to OFF.
Is 28V dc present on P1A-27 during BITE test?
YES
NO
6 Is switch card J13 BITE test OK?
NO
11 Replace switch card J13 in proximity switch box (Ref. 31-22-01)
If problem persists, replace left MLG inboard sensor, 3261-A3 (U1) (Ref. 32-61-08)
YES
12 Replace card J3 in proximity logic box (Ref. 31-22-02)
7 Are relay K6 voltage checks OK?
YES
13 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
8 Are both voltage checks of relay K6 0V dc?
YES
14 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
To Sheet 6
M1-0101-22-447

Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
Figure 103 (Sheet 5)


From Sheet 5
From Sheet 5
3 Monitor voltage on P1B-27 while performing following BITE test of proximity switch box:
● Set CARD TEST SELECTOR to H (Switch Card J28).
● Depress TEST 1/2 switch to TEST 2.
● Set CARD TEST SELECTOR to OFF.
Is 28V dc present on P1S-27 during BITE test?
7 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
4 Is switch card J28 BITE test OK?
NO
YES
8 Replace switch card J28 in proximity switch box (Ref. 31-22-01). If problem persists, replace right MLG outboard sensor 3261-A3 (U2) (Ref. 32-61-09)
9 Replace card J3 in proximity logic box (Ref. 31-22-02)
AUTO GND SPLRS INOP LIGHT
1 Turn on hyd sys C. Move LANDING GEAR control lever to down position.
● Does AUTO GND SPLRS INOP light come on?
5 Check voltages for relay K12 listed in DOWN column of Fig. 104. Are voltage checks for relay K12 OK?
YES
10 Replace MLG hydraulic pressure switch No. 1 (Ref. 32-31-15)
NO
6 Is 0V dc present on P1B-54?
YES
11 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
12 Replace landing gear control (Ref. 32-31-14)
YES
2 Set thrust levers (3) to greater than TO/GA.
● Does AUTO GND SPLRS light remain out?
AUTO GND SPLR INOP LIGHT
13 Replace AFCS/MLG accessory unit (Ref. 27-10-11)
YES
"AFCS/MLG Accessory Unit Interface to FCES OK"
To Sheet 7

M1-0101-22-448

Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
Figure 103 (Sheet 6)


From Sheet 6
1 Check voltages for relay K1 listed in GROUND column of Fig. 104 (roll computer No. 1 only). Are voltage indications OK?
NO
5 Is roll computer No. 1 voltage indication OK?
YES
10 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
NO
6 Is 28V dc present on P1A-20?
YES
11 Replace roll computer No. 1 (Ref. 22-13-01)
NO
YES
2 Check voltage for relay K2 listed in GROUND column of Fig. 104 (roll computer No. 2 only). Is voltage indication OK?
NO
7 Is 28V dc present on P1A-24?
YES
12 Replace AFCS/MLG accessory unit (Ref. 27-10-11)
NO
13 Replace roll computer No. 2 (Ref. 27-13-01)
YES
3 Check voltages for relay K3 listed in GROUND column of Fig. 104 (roll computer No. 1 and trim aug computer only). Are voltage indications OK?
NO
8 Is roll computer No. 2 voltage indication OK?
NO
14 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
YES
9 Is 28V dc present on P1B-16?
NO
15 Replace trim augmentation computer (Ref. 22-18-01)
YES
4 Check voltage for relay K4 listed in GROUND column of Fig. 104 (roll computer No. 2 only). Is voltage indication OK?
NO
16 Replace AFCS/MLG accessory unit (Ref. 22-10-11)
YES
"AFCS/MLG accessory unit interface check OK"

M1-27601-22-454

Trouble Shooting AFCS/MLG Accessory Unit Using T-Cables
Figure 103 (Sheet 7)

AFCS/MLG ACCESS UNIT		TO	TYPE	MEASURE BETWEEN		NORMAL VOLTAGE MEASURED					
						MLG AIR/GROUND SENSOR		LANDING GEAR HANDLE POSITION		TRUCK UNLEVEL SENSOR	
SIGNAL	FROM			HIGH	LOW	GROUND	AIR ⚠1	DOWN	NEUTRAL	LEVEL ⚠2	TILT ⚠3
AIR/GROUND	K1	FCES CMPTR	DC	P1A-32	GND	28 VDC	0 VDC	-	-	-	-
AIR/GROUND	K1	ROLL CMPTR NO. 1	DC	P1A-31	GND	28 VDC	0 VDC	-	-	-	-
AIR/GROUND	K2	FCES CMPTR	DC	P1A-37	GND	28 VDC	0 VDC	-	-	-	-
AIR/GROUND	K2	ROLL CMPTR NO. 2	DC	P1A-35	GND	28 VDC	0 VDC	-	-	-	-
AIR/GROUND	K3	FCES CMPTR	DC	P1B-32	GND	28 VDC	0 VDC	-	-	-	-
AIR/GROUND	K3	ROLL CMPTR NO. 1	DC	P1B-31	GND	28 VDC	0 VDC	-	-	-	
AIR/GROUND	K3	TRIM AUG CMPTR	DC	P1B-33	GND	28 VDC	0 VDC	-	-	-	-
AIR/GROUND	K4	FCES CMPTR	DC	P1B-37	GND	28 VDC	0 VDC	-	-	-	
AIR/GROUND	K4	ROLL CMPTR NO. 2	DC	P1B-35	GND	28 VDC	0 VDC	-	-	-	-
GEAR UP/DN	K10	MLG HYD PRESS SW 1	DC	P1A-59	GND	-	-	28 VDC	0 VDC	-	
GEAR UP/DN	K10	MLG HYD PRESS SW 1	DC	P1A-61	GND	-	-	0 VDC	28 VDC	-	-
GEAR UP DN	K10	MLG HYD PRESS SW 1	DC	P1A-65	GND	-	-	28 VDC	0 VDC	-	-
GEAR UP/DN	K10	MLG HYD PRESS SW 1	DC	P1A-67	GND	-	-	0 VDC	28 VDC	-	-
GEAR UP DN	K12	MLG HYD PRESS SW 2	DC	P1B-59	GND	-	-	28 VDC	0 VDC	-	-
GEAR UP/DN	K12	MLG HYD PRESS SW 2	DC	P1B-61	GND	-	-	0 VDC	28 VDC	-	-
GEAR UP DN	K12	MLG HYD PRESS SW 2	DC	P1B 65	GND	-	-	28 VDC	0 VDC	-	-
GEAR UP DN	K12	MLG HYD PRESS SW 2	DC	P1B-67	GND	-	-	0 VDC	28 VDC	-	
TRUCK TILT	K5	FCES CMPTR	DC	P1A 39	GND		-	-		0 VDC	28 VDC
TRUCK TILT	K5	FCES CMPTR	DC	P1A 26	GND	-	-	-	-	0 VDC	28 VDC
TRUCK TILT	K6	FCES CMPTR	DC	P1B 39	GND	-	-	-		0 VDC	28 VDC
TRUCK TILT	K6	FCES CMPTR	DC	P1B 26	GND	-	-	-	-	0 VDC	28 VDC
TRUCK TILT	K9	FCES CMPTR	DC	P1A 66	GND	-	-			0 VDC	28 VDC
TRUCK TILT	K9	FCES CMPTR	DC	P1A-64	GND	-			-	0 VDC	28 VDC
TRUCK TILT	K11	FCES CMPTR	DC	P1B-66	GND		-	-		0 VDC	28 VDC
TRUCK TILT	K11	FCES CMPTR	DC	P1B-64	GND	-	-	-		0 VDC	28 VDC

WARNING

VERIFY THE FOLLOWING BEFORE MOVING LANDING GEAR CONTROL LEVER TO NEUTRAL POSITION

ALL MLG AND NLG DOWNLOCK SAFETY PINS MUST BE INSTALLED

NOTE

⚠1 AIRBORNE STATE IS SIMULATED BY OPENING FOLLOWING CIRCUIT BREAKERS
- 2L8 FOR RELAYS K1 AND K2
- 2F16 FOR RELAYS K3, AND K4

⚠2 LEVEL = FLAPS <30° OR 2 OF 3 THROTTLE LEVERS >TO/GA

⚠3 TILT = FLAPS >30° AND 2 OF 3 THROTTLE LEVERS <TO/GA AND TILT SIGNAL AS FOLLOWS
- FOR RELAYS K5 AND K9, SET PROX SW BOX CARD TEST SELECTOR TO U (SWITCH CARD J13) AND DEPRESS TEST SWITCH TO TEST 2
- FOR RELAYS K6 AND K11, SET PROX SW BOX CARD TEST SELECTOR TO H (SWITCH CARD J28) AND DEPRESS TEST SWITCH TO TEST 2

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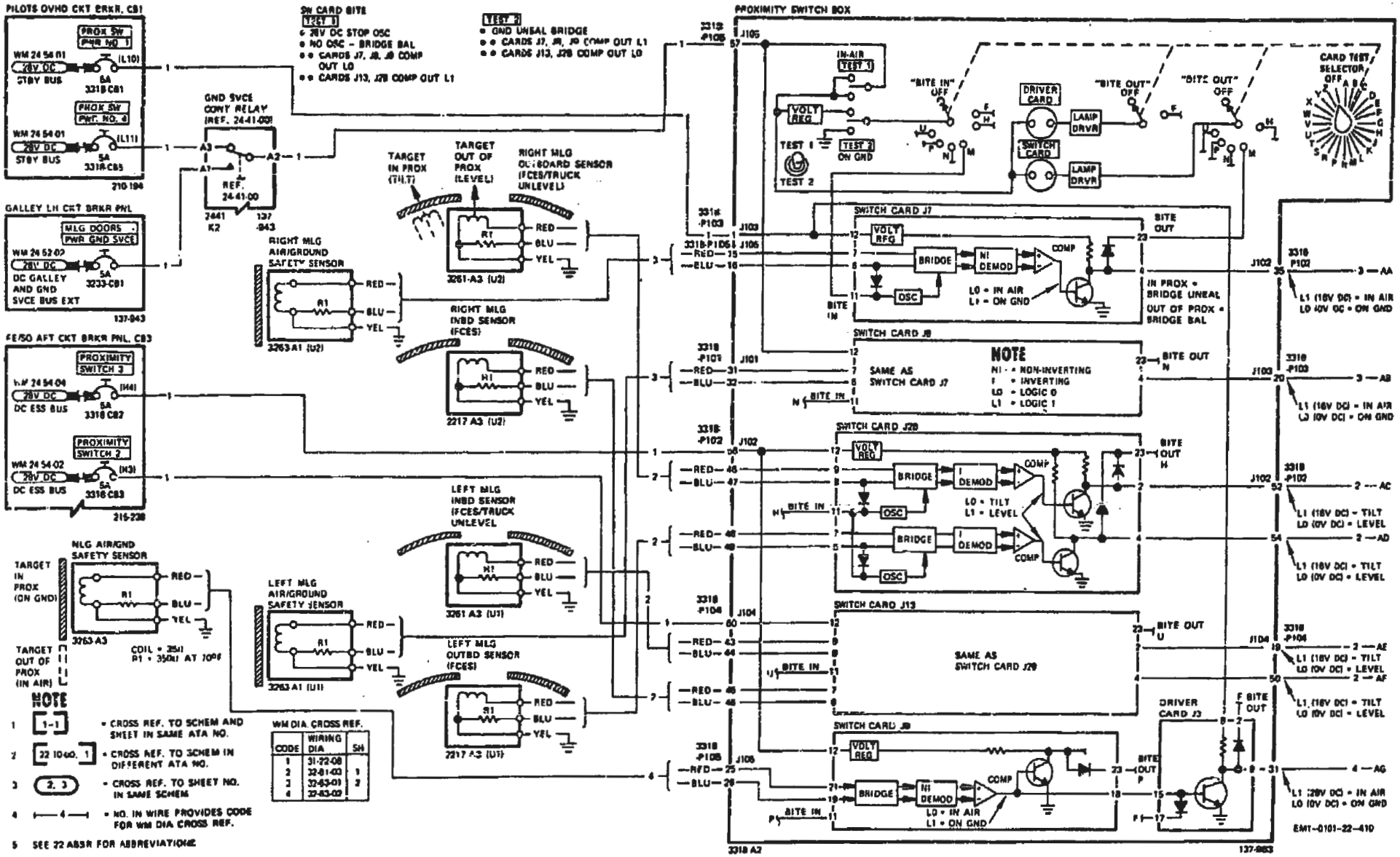
CR AFCS/MLG Accessory Unit T-Cable Voltages Measurements
CR Figure 104

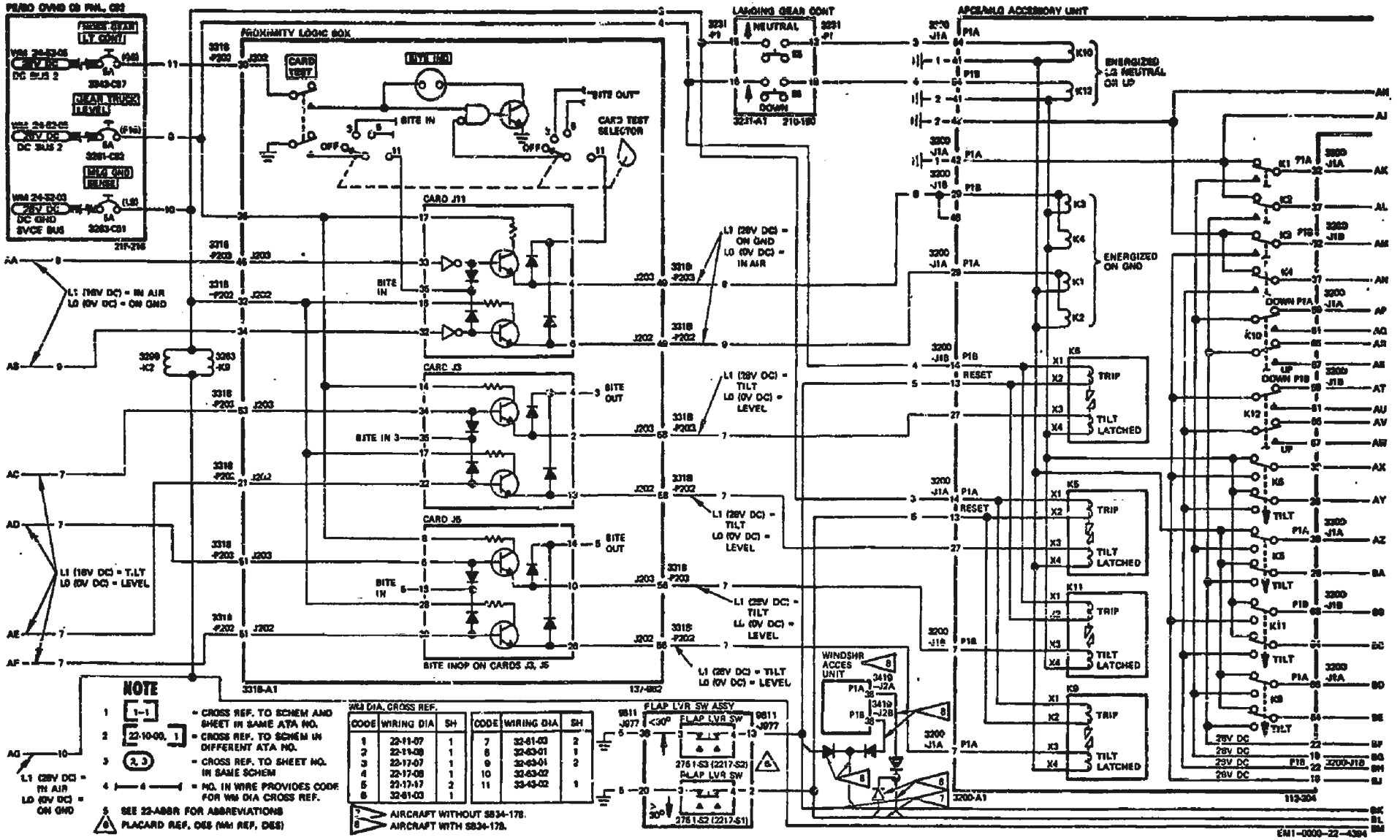
EFFECTIVITY: ALL

001B


PILOTS OVHD CKT BRKR, CB1
PROX SW PWR NO. 1
28V DC STBY BUS
5A 3318 CB1
PROX SW PWR NO. 4
28V DC STBY BUS
5A 3318 CB5
GND SVCE CONT RELAY (REF. 24-41-00)
REF. 24-41-00
GALLEY LH CKT BRKR PNL
MLG DOORS PWR GND SVCE
28V DC DC GALLEY AND GND SVCE BUS EXT
5A 3233-CB1
FE/SO AFT CKT BRKR PNL, CB3
PROXIMITY SWITCH 3
28V DC DC ESS BUS
5A 3318 CB2
PROXIMITY SWITCH 2
28V DC DC ESS BUS
5A 3318 CB3
SW CARD BITE
TEST 1
• 28V DC STOP OSC
• NO OSC - BRIDGE BAL
•• CARDS J7, J8, J9 COMP OUT L0
•• CARDS J13, J28 COMP OUT L1
TEST 2
• GND UNBAL BRIDGE
•• CARDS J7, J8, J9 COMP OUT L1
•• CARDS J13, J28 COMP OUT L0
PROXIMITY SWITCH BOX
IN-AIR TEST 1
VOLT REG
TEST 1
TEST 2
ON GND
"BITE IN" OFF
DRIVER CARD
SWITCH CARD
LAMP DRVR
"BITE OUT" OFF
"BITE OUT" OFF
CARD TEST SELECTOR OFF
TARGET IN PROX (TILT)
TARGET OUT OF PROX (LEVEL)
RIGHT MLG OUTBOARD SENSOR (FCES/TRUCK UNLEVEL)
RIGHT MLG AIR/GROUND SAFETY SENSOR
3263 A1 (U2)
3261 A3 (U2)
RIGHT MLG INBD SENSOR (FCES)
2217 A3 (U2)
SWITCH CARD J7
SWITCH CARD J8
SWITCH CARD J28
SWITCH CARD J13
SWITCH CARD J9
BRIDGE
NI DEMOD
COMP
OSC
BITE IN
BITE OUT
IN PROX = BRIDGE UNBAL
OUT OF PROX = BRIDGE BAL
LO = IN AIR
L1 = ON GND
SAME AS SWITCH CARD J7
SAME AS SWITCH CARD J28
NOTE
NI - = NON-INVERTING
I = INVERTING
L0 = LOGIC 0
L1 = LOGIC 1
LO = TILT
L1 = LEVEL
DRIVER CARD J3
F BITE OUT
L1 (28V DC) = IN AIR
L0 (0V DC) = ON GND
L1 (18V DC) = TILT
L0 (0V DC) = LEVEL
EMT-0101-22-410
NLG AIR/GND SAFETY SENSOR
TARGET IN PROX (ON GND)
TARGET OUT OF PROX (IN AIR)
3263 A3
COIL = 25Ω
R1 = 350Ω AT 70°F
LEFT MLG AIR/GROUND SAFETY SENSOR
3263 A1 (U1)
LEFT MLG INBD SENSOR (FCES/TRUCK UNLEVEL)
3261 A3 (U1)
LEFT MLG OUTBD SENSOR (FCES)
2217 A3 (U1)
NOTE
1 1-1 • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 22 10&0, 1 • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 2, 3 • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22 ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE WIRING DIA SH
1 31-22-08
2 22-81-03 1
3 22-83-01 2
4 22-83-02
3318 A2
137-883

AFCS/MLG Accessory Unit Interface Schematic
SCHEM 1 (Sheet 1)

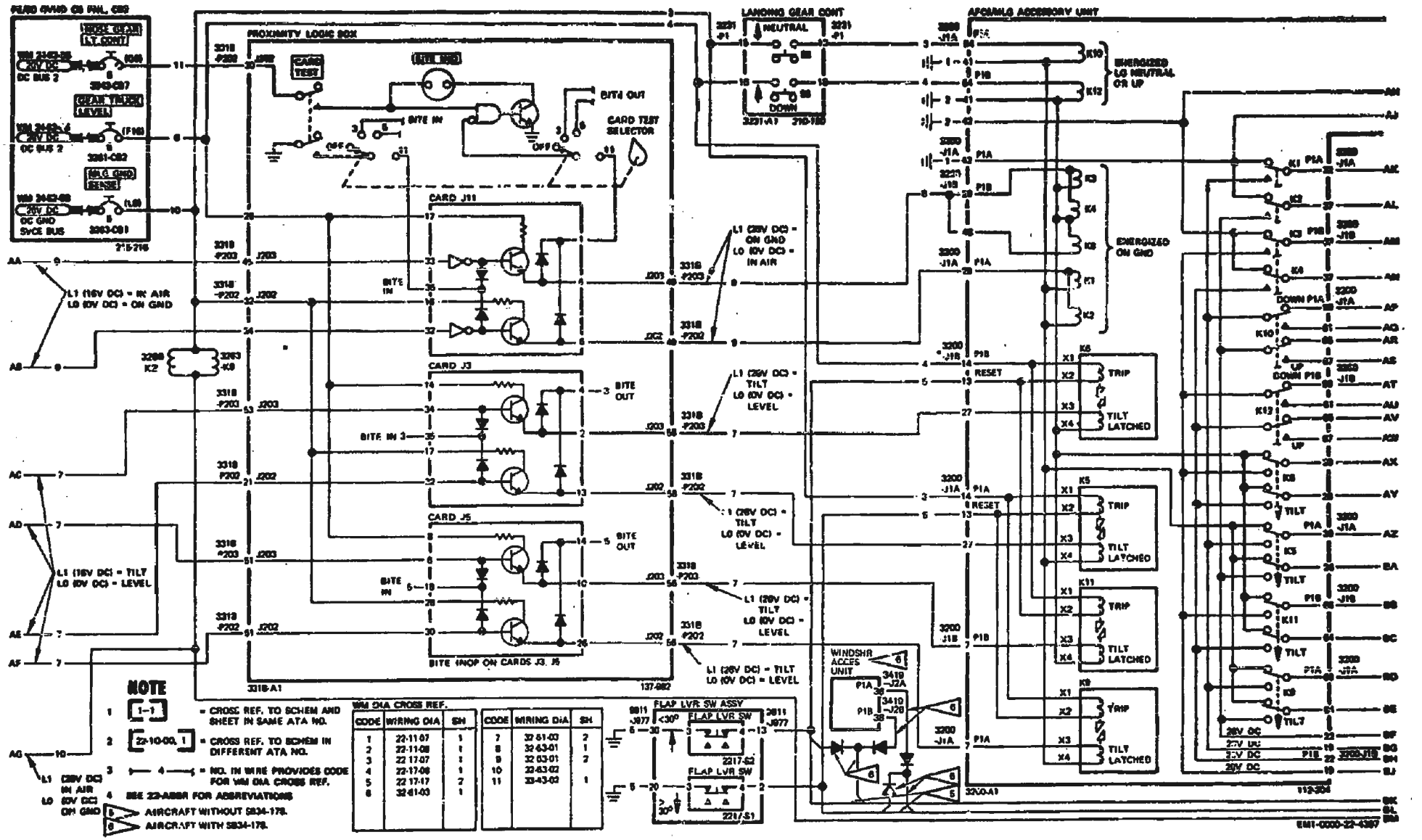
R
R
001B EFFECTIVITY: ALL



R AFCS/MLG Accessory Unit Interface Schematic
R SCHEM 1 (Sheet 2)

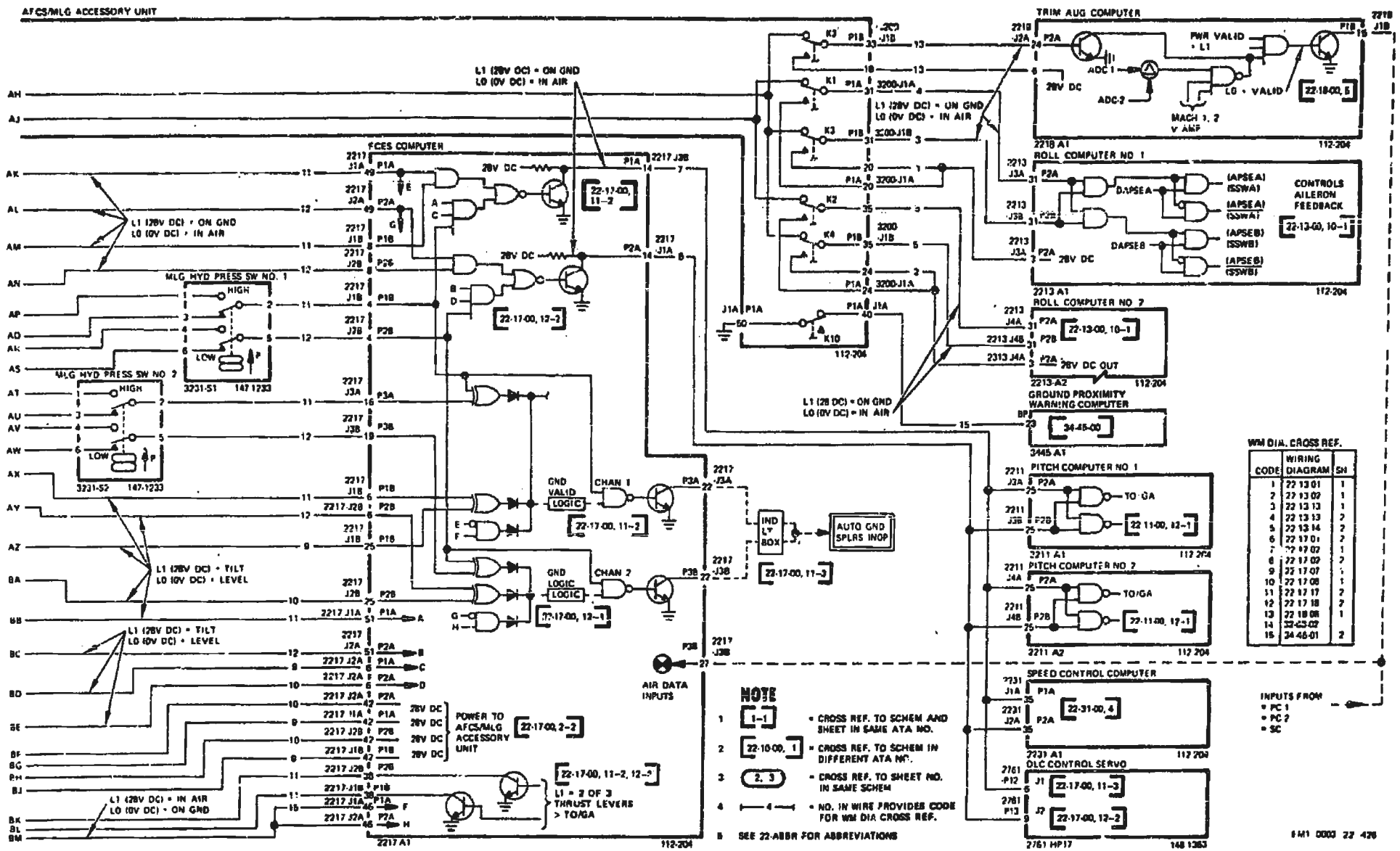
EFFECTIVITY: 001-031

001B



R AFCS/MLG Accessory Unit Interface Schematic
R SCHEM 1 (Sheet 2)

EFFECTIVITY: 032-999


AFCS/MLG ACCESSORY UNIT
FCES COMPUTER
TRIM AUG COMPUTER
ROLL COMPUTER NO. 1
ROLL COMPUTER NO. 2
GROUND PROXIMITY WARNING COMPUTER
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
SPEED CONTROL COMPUTER
OLC CONTROL SERVO
MLG HYD PRESS SW NO. 1
MLG HYD PRESS SW NO. 2
L1 (28V DC) = ON GND
L0 (0V DC) = IN AIR
L1 (28V DC) = TILT
L0 (0V DC) = LEVEL
L1 (28V DC) = IN AIR
L0 (0V DC) = ON GND
28V DC
GND VALID LOGIC
CHAN 1
CHAN 2
AUTO GND SPLRS INOP
AIR DATA INPUTS
POWER TO AFCS/MLG ACCESSORY UNIT
L1 = 2 OF 3 THRUST LEVERS > TO/GA
CONTROLS AILERON FEEDBACK
GROUND PROXIMITY WARNING COMPUTER
INPUTS FROM
• PC 1
• PC 2
• SC
WM DIA. CROSS REF.
CODE
WIRING DIAGRAM
SH
NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 [2, 3] • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS

AFCS/MLG Accessory Unit Interface Schematic
SCHEM 1 (Sheet 3)

R EFFECTIVITY: ALL
R
0018

AFCS/MLG ACCESSORY UNIT - REMOVAL AND INSTALLATION

1. Referenced Procedures

R 21-00-00 Air Conditioning System - Maintenance Practices

24-00-00 Electrical Power - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - PITCH & ROLL (A6)

NO. 2 SYSTEMS - PITCH & ROLL (A24)

FCES - CMPTR - AC & L AOA (B5)

NO. 1 SYSTEMS - TRIM AGMT - AC (A7)

NO. 2 SYSTEMS - TRIM AGMT - AC (A25)

AUTO THROT SERVO (A1)

NO. 2 SYSTEMS - SPEED CONT (A20)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers DLC SERVO - A (H14) and DLC SERVO - B (H15).

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate accessory unit in center rack (Ref. Fig. 401).

(3) Release holddown on accessory unit front panel.

(4) Pull accessory unit handle to release accessory unit electrical connectors from mount connectors.

(5) Slide accessory unit out of mount.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Slide accessory unit (Ref. Fig. 401) into mount until accessory unit rear electrical connectors mate with mount connectors.

(3) Secure accessory unit with holddown.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Perform operational test in Step C.

C. Operational Test

(1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that avionics cooling is on (Ref. 21-00-00).

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

All circuit breakers on AVIONICS FLIGHT CONTROL SYSTEM strips

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

FLIGHT STATION MISC

R AOA (F1)

STICK SHAKE (F2)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

(4) On FCES control panel, depress STALL WARN 1 and 2 switchlights to on.

(5) Depress STALL WARN 2 switchlight to OFF.

(6) Depress and hold STALL WARN TEST switch. Verify that both control columns vibrate.

(7) Release STALL WARN TEST switch.

R (8) Depress STALL WARN 2 switchlight to on and depress
R STALL WARN 1 switchlight to OFF.

R (9) Depress and hold STALL WARN TEST switch. Verify that
R both control columns vibrate.

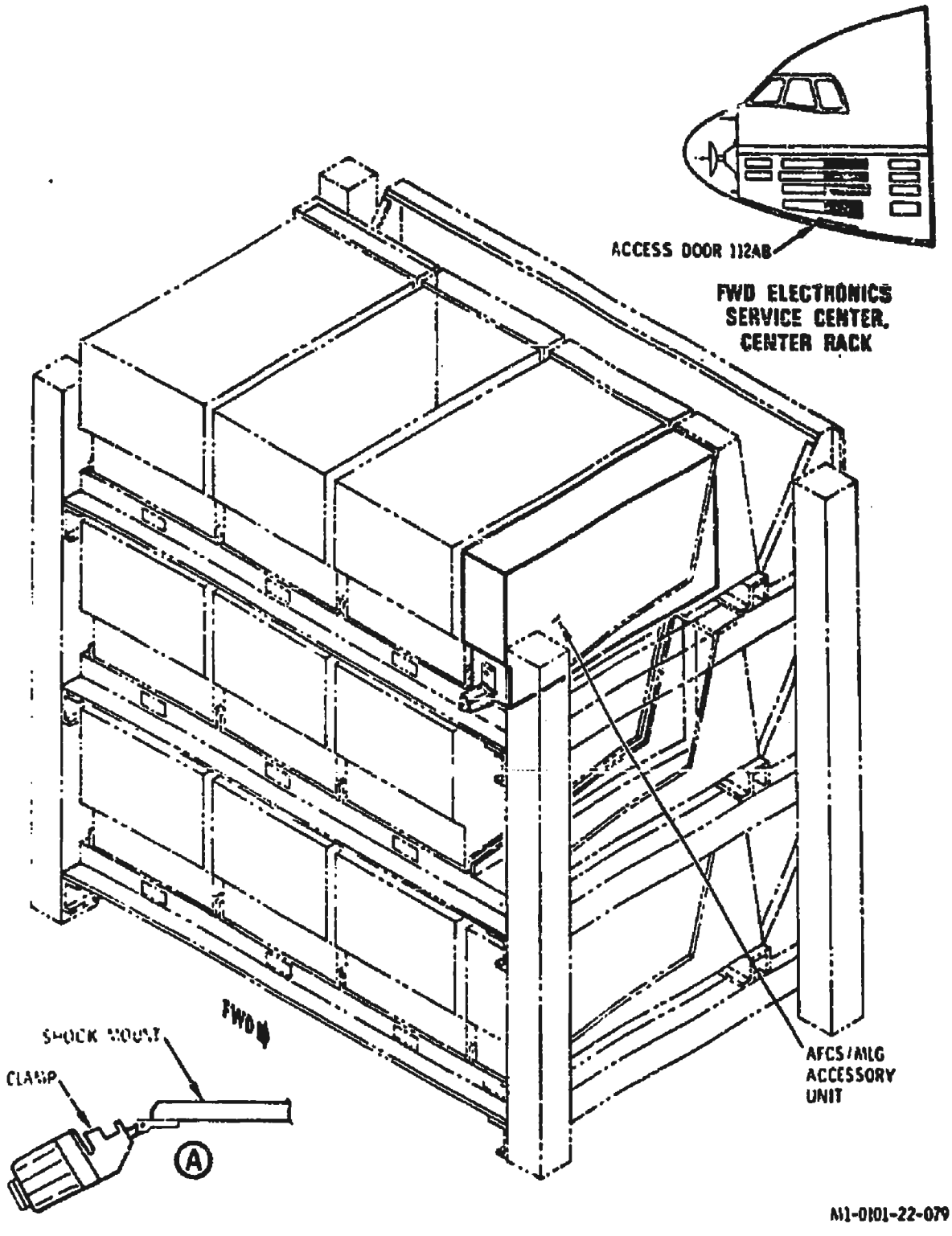
R (10) Release STALL WARN TEST switch.

R (11) Depress STALL WARN 1 switchlight to on.

R (12) Depress and hold STALL WARN TEST switch. Verify that
R both control columns vibrate.

R (13) Release STALL WARN TEST switch.

R (14) Turn off electrical power (Ref. 24-00-00).



AFCS/MLG Accessory Unit - Removal and Installation
Figure 401

CR AFCS/MLG ACCESSORY UNIT - ADJUSTMENT/TEST

CR 1. General

CR This procedure checks the integrity of DLC/AGSB landing gear, flap and throttle logic inputs to the FCES computer including the AFCS/MLG accessory unit. This procedure may be used to troubleshoot DLC/AGSB problems when it is suspected that the problem is not being caused by a malfunction in the FCES computer or DLC servo. The following simplified schematics published in the Wiring Diagram Manual should be used as an aid in isolating malfunctions indicated by this procedure:

22-17-00	Schematic 11
31-22-00	Schematics 1 and 4
32-63-00	Schematic 1

CR 2. Equipment and Materials

CR A. FCES Breakout Box, EQ 1196-3

CR B. Voltmeter, 0 to 30 vD.C.

CR 3. Preparation

CR A. All hydraulic power OFF.

CR B. Flap handle in the 22 degree position.

CR NOTE: Flaps may be in any position.

CR C. Throttles at IDLE position.

CR D. Gear handle DOWN and aircraft weight on gear.

CR E. No targets on gear.

CR F. FCES breakout box, EQ 1196-3 installed.

CR G. Negative lead of voltmeter connected to P1A-3 or P2A-3 on CR FCES breakout box.

CR H. Electrical power ON.

CR 4. Adjustment/Test

CR A. Test Flap Logic

CR (1) Using the positive lead of the voltmeter check that the CR logic is LO at P1A-47, P2A-47, P1B-19 and P2B-19.

CR NOTE: A 0 volt reading is a LO logic and a 28v DC CR reading is a HI logic.

CR (2) Move the flap handle to the 33 DEGREE position. Check CR that the logics in the preceding step are now HI.

CR (3) Move the flap handle back to the 22 DEGREE position. CR Recheck that all logics have returned to LO.

CR B. Test Nose Landing Gear Logic

CR (1) Check that the logic is LO at P1A-46 and P2A-46.

CR (2) Place an aluminum shim in the nose gear oleo proximity CR sensor. Check that the logics in the preceding step CR are now HI.

CR (3) Remove the aluminum shim from the nose gear oleo CR proximity sensor. Recheck that the logics return to CR LO.

CR C. Test Left Main Landing Gear Logic

CR (1) Check that the logic is HI at P1A-49 and P2A-49.

CR (2) Place an aluminum shim in the left main gear oleo CR proximity sensor. Check that logics in the preceding CR step are now LO.

CR (3) Remove the aluminum shim from the left main gear oleo CR proximity sensor. Recheck that the logics return to CR HI.

CR D. Test Right Main Landing Gear Logic

CR (1) Check that the logic is HI at P1B-8 and P2B-8.

CR (2) Place an aluminum shim in the right main gear oleo CR proximity sensor. Check that logics in the preceding CR step are now LO.

CR (3) Remove the aluminum shim from the right main gear oleo CR proximity sensor. Recheck that the logics return to CR HI.

CR E. Test Left Truck Level Logic

CR (1) Move the flap handle to the 33 DEGREE position.

CR (2) Check that the logic is LO at P1B-25, P2B-25, P1A-51
CR and P1B-51.

CR (3) Place a steel shim in both left bogie proximity
CR sensors. Check that logics in the preceding step are
CR now HI.

CR (4) Remove the steel shim from both left bogie proximity
CR sensors. Check that logics in step (3) remain HI.

CR (5) Move the flap handle to the 22 DEGREE position. Check
CR that logics in the preceding step are now LO.

CR F. Test Right Truck Level Logic

CR (1) Move flap handle to the 33 DEGREE position.

CR (2) Check that the logic is LO at P1A-6, P2A-6, P1B-6 and
CR P2B-6.

CR (3) Place a steel shim in both right bogie proximity
CR sensors. Check that the logics in the preceding step
CR are now HI.

CR (4) Remove the steel shims from both right bogie proximity
CR sensors. Check that the logics in step (3) remain HI.

CR (5) Move the flap handle to the 22 DEGREE position. Check
CR that the logics in the preceding step are now LO.

CR G. Test Main Landing Gear Hydraulic Power Logic

CR (1) Check that the logic is LO at P1B-4, P2B-4, P3A-16 and
CR P3B-19.

CR NOTE: Before moving the landing gear handle, all gears
CR must have gear pins installed and a nose
CR fuselage jack must be used under the aircraft
CR per applicable maintenance manual procedures.

CR (2) Move the landing gear handle to the NEUTRAL position.
CR Check that the logics in the preceding step are now HI.

CR (3) Return the landing gear handle to the DOWN position.
CR Check that the logics in the preceding step are now LO.

CR (4) Turn ON C hydraulic power. Check that the logics in
CR the preceding step are now HI.

CR (5) Turn OFF C hydraulic power. Check that the logics in
CR the preceding step are now LO.

CR H. Test Throttle Logic

CR (1) Check that TAKE OFF logic is HI at P1A-45, P1A-44, P1A-54, P2A-45, P2A-44 and P2A-54.

CR (2) Move all throttles to the TAKE OFF position. Check that all logics in step (1) are now LO.

CR (3) Move all throttles to the IDLE position. Re-check that all logics in step (1) have returned to HI.

CR (4) Check that REVERSE logic is LO at P1A-40, P1A-39, P1A-48, P2A-40, P2A-39 and P2A-48.

CR (5) Move all throttles to the REVERSE position. Check that all logics in step (4) are now HI.

CR (6) Move all throttles to the IDLE position. Recheck that all logics in step (4) have returned to LO.

CR J. Test Completion

CR (1) Turn OFF electrical power.

CR (2) Remove EQ1196-3 FCES breakout box and voltmeter.

CR (3) Remove all gear pins and nose fuselage jack.

FLIGHT CONTROL AUXILIARY UNIT (FCAU) - MAINTENANCE PRACTICES

1. General

All functions/indicators of the flight control auxiliary unit may be inoperative provided:

The unit is installed and connected.

The surface position indicator (See 27-00-01) is fully operative.

It does not render any other system or equipment inoperative.

2. Referenced Procedures

27-00-01 Surface Position Indicator - Adjustment and Test

3. Maintenance Practices

A. Deactivation of FCAU

R R R NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

(1) Make certain that FCAU is installed and connected.

(2) Perform surface position indicator adjustment and test (Ref. 27-00-01).

(3) Make certain that FCAU does not render any other system or equipment inoperative.

(4) Install "FCAU Inoperative" placard in flight station.

(5) Make appropriate entry in aircraft log book.

FLIGHT CONTROL AUXILIARY UNIT - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-10-12 Flight Control Auxiliary Unit - Adjustment and Test

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL
R SYSTEM - SPOILER DWELL - DC (B7).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following circuit breakers:

R SPOILER SERVO B - 1, 4, 6 L&R (J16)

R RUDDER SERVO - A (K12)

R RUDDER SERVO - B (K13)

R RUDDER SERVO - C (K14)

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate flight control auxiliary unit in center rack.

(3) Disconnect electrical connectors from left side of unit.

(4) Remove mounting screws and nuts, and remove unit.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Position flight control auxiliary unit on mounting angles and secure with screws and nuts.

(3) Connect electrical connectors.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

R (6) Perform flight control auxiliary unit adjustment and
R test (Ref. 22-10-12).

FLIGHT CONTROL AUXILIARY UNIT - ADJUSTMENT AND TEST

1. General

The flight control auxiliary unit adjustment and test consists of a spoiler mode control BITE test and a rudder hydraulic limiter BITE test. The adjustment and test is to be performed whenever a flight control auxiliary unit is replaced. Purpose of the test is to validate the unit operation and not to test the entire system operation. The adjustment and test requires that all associated equipment is installed and operational.

2. Referenced Procedures

	21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
	24-00-00	Electrical Power - Maintenance Practices
R	27-51-00	Flap Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Adjustment/Test

A. Preliminary Procedure

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionic cooling is on (Ref. 21-25-00).

(3) On pilots overhead circuit breaker panel CB1, ensure that the following circuit breakers are closed:

FCES COMPUTERS DC (B4)

SPOILER DWELL DC (B7)

SPOILER DWELL AC (B8)

NO. 2 ASYM BK LE SLAT (J10)

NO. 2 ASYM BK TE FLAP (J11)

LOCK LIGHT LE SLAT (J12)

LOCK LIGHT TE FLAP (J13)

AURAL WARN MULT SND (L8)

(4) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, ensure that the following circuit breakers are closed:

FLAP LOAD RELIEF CHAN 1 (H12)

FLAP LOAD RELIEF IND (H13)

FLAP LOAD RELIEF CHAN 2 (H20)

NO. 1 ASYM BRAKE TE FLAP (H21)

NO. 1 ASYM BRAKE LE SLAT (H22)

(5) On Flight Engineer/Second Officers aft circuit breaker panel CB3, ensure that the following circuit breakers are closed:

IND LT PFCS ADS/DH (G8)

IND LT FLT CONT ALT ALERT (G9)

POS IND TE FLAP (K16)

POS IND LE SLAT (K17)

LE SLAT EXTEND LT (K18)

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(6) Turn on hydraulic system A, B, C, and D (Ref. 29-11-00).

R **CAUTION:** PRIOR TO GROUND OPERATION OF WING FLAPS, OBSERVE FOLLOWING TO PREVENT SPOILER SELECTOR DWELL ACTUATOR STALL:

AILERONS FAIRED ±10 DEGREES.

SPEED BRAKE LEVER WITHIN 2 INCHES OF 0 DEGREES.

(7) Set speedbrake handle to 0 degrees.

(8) Set flaps to 0 degrees. Verify that flaps are retracted.

(9) In FESC, verify that all Flight Control Auxiliary Unit (FCAU) lights and legends are off.

(10) On FCAU, depress and release LAMP TEST pushbutton.

RESULT:

SELECTOR FAULT, MIXER FAULT, SPOILER 1 FAULT, HYD-LMTR, A OFF, B OFF, C OFF and C-REG ON lights come on when pushbutton is depressed.

(11) In FESC, ensure that LRS computer BITE switch is set to RUN.

B. Spoiler Mode Control BITE Test

(1) On FCAU, depress and hold MANUAL switch, then position and hold FLAPS switch UP.

RESULT:

On FCAU, the three SPOILER fault legends remain off.

(2) While depressing MANUAL switch, position and hold FLAPS switch DOWN.

RESULT:

On FCAU, SELECTOR FAULT, MIXER FAULT and SPOILER 1 FAULT legends come on after approximately 25 seconds. On pilots caution and warning panel, ROLL SPD BRAKES and FLT CONT PANELS legends (after slight delay) flash for 10 seconds and then go steady.

On pilots overhead PFCS panel, SPOILER L5 & 6 and R5 & 6 PUSH legends come on after slight delay.

(3) Release MANUAL and FLAPS switches.

RESULT:

All legends that came on in Step (2) go off, except FLT CONT PANELS legend may not go off.

(4) Reset FLT CONT PANELS legend, if on.

(5) Set flaps to 4 degrees or greater.

RESULT:

Slats extend fully, and flaps move to selected position.

(6) Depress and hold MANUAL switch, then position and hold FLAPS switch to DOWN.

RESULT:

The three SPOILER fault legends remain off.

(7) While depressing MANUAL switch, position and hold FLAPS switch to UP.

RESULT:

On FCAU, SELECTOR FAULT, MIXER FAULT, and SPOILER 1 FAULT legends come on after approximately 25 seconds. On pilots caution and warning panel, ROLL SPD BRAKES and FLT CONT PANELS legends (after slight delay) flash for 10 seconds and then go steady.

On pilots overhead PFCS panel, SPOILER L5 & 6 and R5 & 6 PUSH legends come on.

(8) Release MANUAL and FLAPS switches.

RESULT:

All legends that came on in Step (7) go off, except FLT CONT PANELS legend may not go off.

(9) Reset FLT CONT PANELS legend, if on.

(10) Set flaps to 0 degrees.

C. Rudder Hydraulic Limiter BITE Test

(1) On pilots overhead flight control panel, set switches as follows:

Switch	Position
RUDDER LIMITER =	
HYDRAULIC "PUSH/OVRD"	in (dark)
On aircraft 001-017, MECHANICAL "MNL/PUSH"	in (dark)
On aircraft 001-017, MECHANICAL "±8°/±30°"	in (±30°)

(2) On FCAU, depress and hold RUDDER HYDRAULIC LIMITER A switch.

RESULT:

On pilots caution and warning panel, RUDDER HYDR LMTR legend flashes for 10 seconds, then goes steady.

On FCAU, RUDDER HYDRAULIC LIMITER A OFF light and HYDR LMTR FAULT legend come on.

(3) Release A switch.

RESULT:

All legends that came on in Step (2) go off.

(4) Depress and hold RUDDER HYDRAULIC LIMITER B switch.

RESULT:

On pilots caution and warning panel, RUDDER HYDR LMTR legend flashes for 10 seconds then goes steady.

On FCAU, RUDDER HYDRAULIC LIMITER B OFF light and HYDR LMTR FAULT legend come on.

(5) Release B switch.

RESULT:

All legends that came on in Step (4) go off.

(6) Depress and hold RUDDER HYDRAULIC LIMITER C switch.

RESULT:

On pilots caution and warning panel, RUDDER HYDR LMTR legend flashes for 10 seconds then goes steady.

On FCAU, RUDDER HYDRAULIC LIMITER C OFF light and HYDR LMTR FAULT legend come on.

(7) Release C switch.

RESULT:

All legends that came on in Step (6) go off.

(8) Depress and hold RUDDER LIMITER C REG switch.

RESULT:

On pilots caution and warning panel, RUDDER HYDR LMTR legend flashes for 10 seconds then goes steady.

On FCAU, RUDDER HYDRAULIC LIMITER C REG ON light and HYD-LMTR FAULT legend comes on.

(9) Release C REG switch.

RESULT:

All legends that came on in Step (8) go off.

(10) Depress and hold RUDDER LIMITER A and C switches.

RESULT:

On pilots overhead flight control panel, RUDDER LIMITER HYDRAULIC "PUSH" legend comes on.

On pilots caution and warning panel, RUDDER HYDR LMTR and FLT CONT PANELS legends flash for 10 seconds, then go steady.

On FCAU, RUDDER HYDRAULIC LIMITER A OFF, C OFF, and HYDR LMTR FAULT legends come on.

(11) Release A and C switches.

RESULT:

All legends that came on in Step (10) go off, except FLT CONT PANELS legend which may not go off.

(12) Reset FLT CONT PANELS legend, if on.

(13) Set flaps to 4 degrees or greater.

(14) On FCAU, depress and hold RUDDER HYD LIMITER A switch.

RESULT:

On pilots caution and warning panel, RUDDER HYDR LMTR and FLT CONT PANELS legends flash for 10 seconds and then go steady.

On FCAU, RUDDER HYDRAULIC LIMITER A OFF light and HYDR LMTR FAULT legend come on.

On pilots overhead light control panel, RUDDER LIMITER HYDRAULIC "PUSH" legend comes on.

(15) Release A switch.

RESULT:

All legends that come on in Step (14) go off.

D. Test Completion

(1) Turn off hydraulic power (Ref. 29-11-00).

(2) Turn off electrical power (Ref. 24-00-00).

(3) Set flaps to 0 degrees.

R AUTOPILOT DISCONNECT SWITCH - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 20-00-05 Soldering Procedures and Requirements for the L1011 R Aircraft (Wiring Diagram Manual)

R 20-11-00 Hydraulic Power System - Maintenance Practices

R 2. Equipment and Materials

R Adhesive, SM1484-05 (Lear Siegler, Inc.), or equivalent

R Epoxy paint, 005-8295-010 (Collins), or equivalent

R 3. Removal/Installation

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF R (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND R HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210, R open and tag the following circuit breakers:

R AVIONICS FLIGHT CONTROL SYSTEM

R NO. 1 SYSTEM

R PITCH & ROLL (A6)

R NO. 2 SYSTEM

R PITCH & ROLL (A24)

R (2) Locate electrical pitch trim generator on outboard side R of control wheel, zone 210 (Ref. Fig. 401).

R (3) Remove screws securing generator cover and remove R cover. Retain screws and cover.

R (4) Remove screws securing generator to control wheel. R Retain screws.

R (5) Remove generator assembly from control wheel and gently R pull wires for slack.

(6) Remove setscrew and gently extend switch as far as wiring harness will allow.

(7) Tag wires. Make note of coding and placement of wires.

(8) Unsolder switch and unscrew switch shield if required.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Screw switch into switch shield and resolder wires (Ref. Wiring Diagram Manual 20-00-05).

(3) Using adhesive on setscrew, secure switch shield in control wheel.

(4) Position generator on control wheel and secure with screws. Install generator cover and secure with screws.

(5) Touch-up finish coat of screws with black epoxy paint.

(6) Perform operational test in Step C.

C. Operational Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

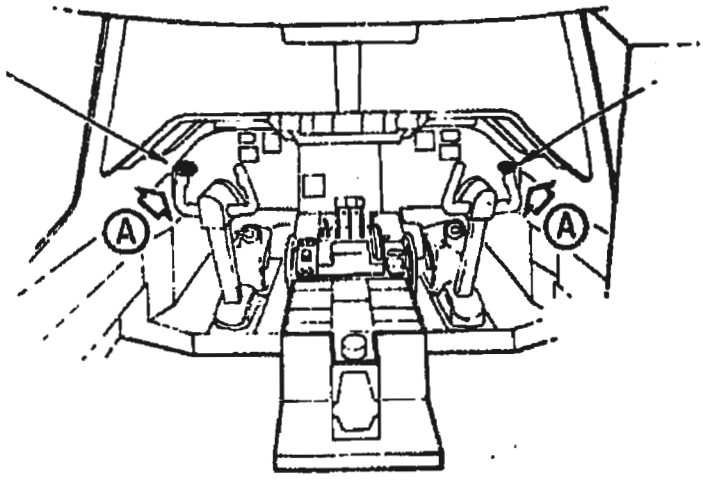
THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

WARNING: DO NOT ENGAGE THE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

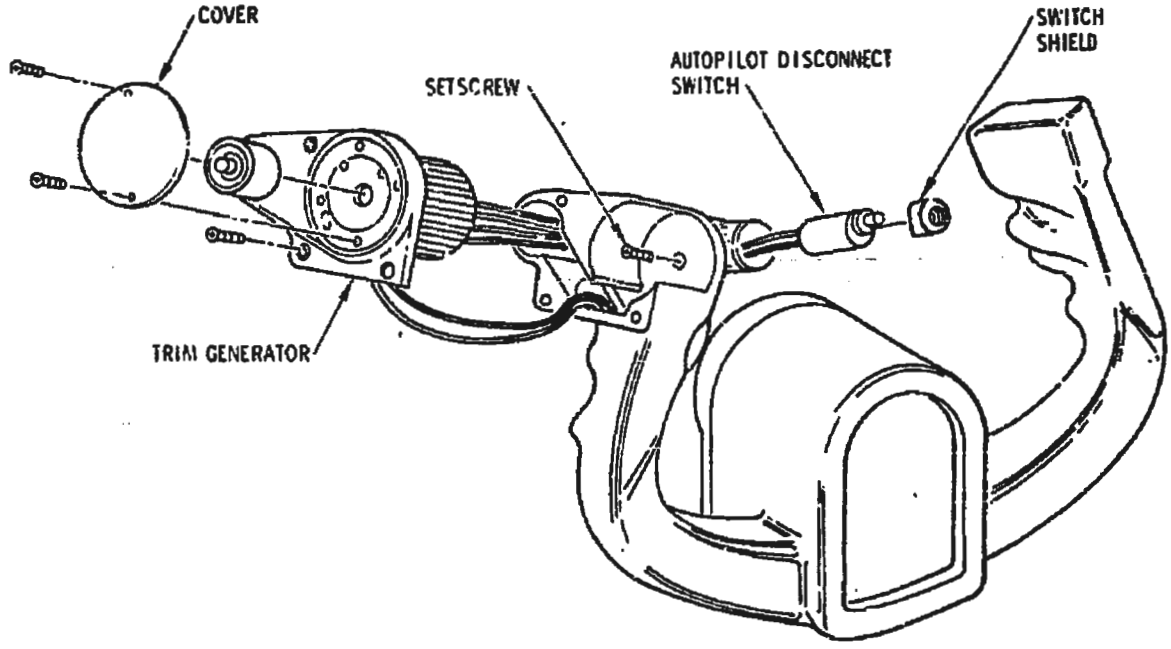
(1) Turn on hydraulic systems A and B (Reference 29-11-00).

R (2) On aircraft 001-024, 027,
R set AP A switch to CWS.

R (2) On aircraft 025, 026, 028-999,
R set mode selector to ATT on all mode selector panels.



ZONE 210



MI-0100-22-1309

R R Autopilot Switch - Removal and Installation
Figure 401

R R 0018 EFFECTIVITY: ALL

R When ATT flags on both ADI go out of view and ATT 3
R legend on CAWP goes out, set AP A switch to CWS.

(3) On control wheel that switch was replaced, depress A/P disengage switch.

RESULT:

AP A switch drops to OFF.

On both AFCS WARNING annunciators, AP DISC and flashing ALERT displays come on.

(4) Depress A/P disengage switch.

RESULT:

AP DISC and flashing ALERT displays go out.

(5) Set AP B switch to CWS.

(6) On control wheel that switch was replaced, depress A/P disengage switch.

RESULT:

AP B switch drops to OFF.

On both AFCS WARNING annunciators, AP DISC and flashing ALERT displays come on.

(7) Depress A/P disengage switch.

RESULT:

AP DISC and flashing ALERT displays go out.

(8) Turn off hydraulic systems.

R CAUTION: ON AIRCRAFT 025, 026, 028-999,
R INS BATTERIES MAY BE DISCHARGED UPON REMOVAL OF
R AIRCRAFT POWER IF MODE SELECTOR SWITCH IS NOT SET
R TO OFF.

R (9) On aircraft 025, 026, 028-999,
R set mode selector switch to OFF on all mode selector
R panels.

R CONTROL WHEEL GO-AROUND SWITCH - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 20-00-05 Soldering Procedures and Requirements for the L1011
R Aircraft (Wiring Diagram Manual)

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 2. Equipment and Materials

R Adhesive, SM1484-05 (Lear Siegler, Inc.), or equivalent

R Epoxy paint, 005-8295-010 (Collins), or equivalent

R 3. Removal/Installation

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF
R (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND
R OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND
R HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210,
R open and tag the following circuit breakers:

R AVIONICS FLIGHT CONTROL SYSTEM

R NO. 1 SYSTEM

R PITCH & ROLL (A6)

R NO. 2 SYSTEM

R PITCH & ROLL (A24)

R (2) Locate electrical pitch trim generator on outboard side
R of control wheel, zone 210 (Ref. Fig. 401).

R (3) Remove screws securing generator cover and remove
R cover. Retain screws and cover.

R (4) Remove screws securing generator to control wheel.
R Retain screws.

R (5) Remove generator from control wheel and gently pull
R wires for slack.

(6) Tag wires. Make note of coding and placement of wires.

(7) Unsolder wires to switch. Hold generator, unscrew switch from switch shield.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

CAUTION: DO NOT TWIST OR APPLY EXCESSIVE TENSION ON TRIM GENERATOR WIRING.

(2) Apply adhesive on go-around switch threads, and screw switch into switch shield on generator assembly.

NOTE: Go-around switch shield is pressed into generator assembly. If shield has rotated, rotate it so that the words GO-AROUND will face upward.

(3) Solder wires to switch as identified by tags. (Ref. Wiring Diagram Manual 20-00-05).

(4) Position generator on control wheel and secure with screws. Install generator cover and secure with screws.

(5) Touch-up finish coat of screws with black epoxy paint.

(6) Perform operational test in Step C.

C. Operational Test

(1) Open circuit breaker A24 on panel CB1.

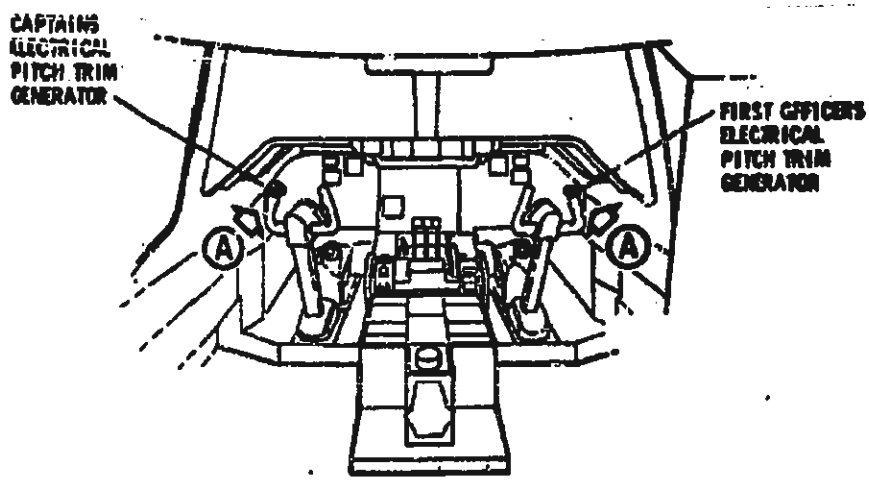
(2) Simulate 'airborne' condition by either removing the AFCS/MLG accessory unit, or by opening circuit breaker L8 or F16 on panel CB2.

(3) On APFDS ENGAGE panel, set FD A switch to ON.

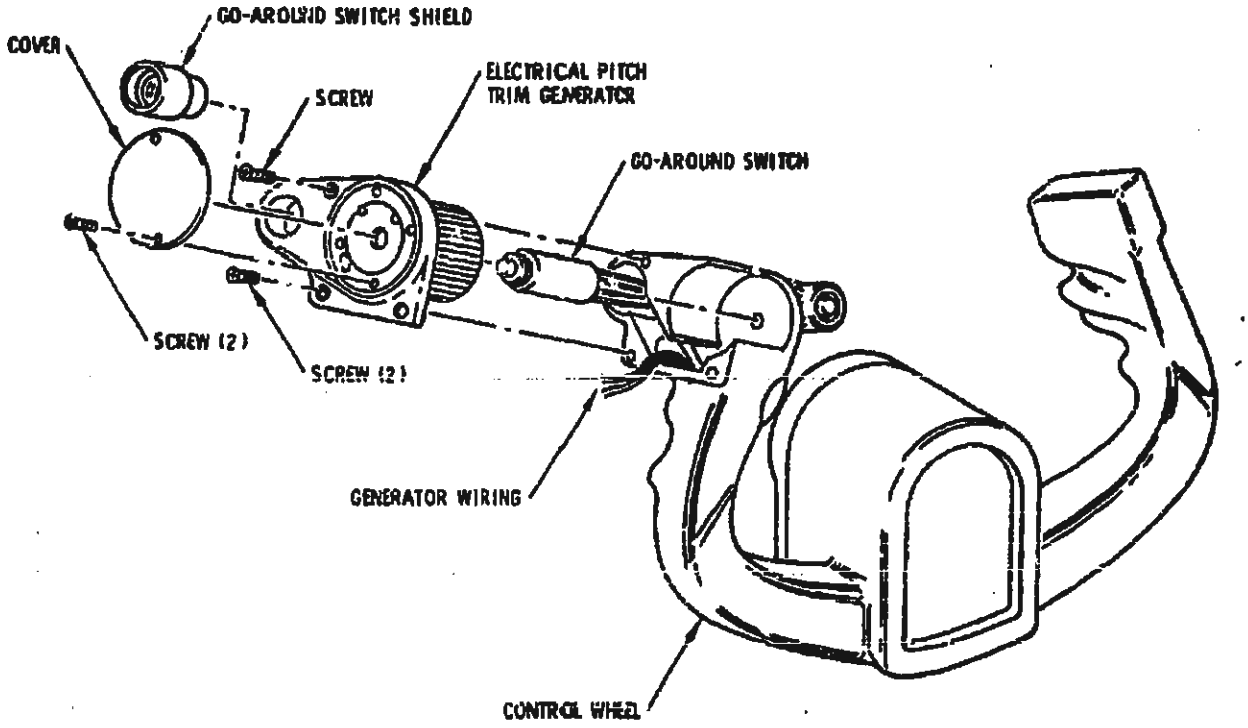
R (4) On control wheel, depress replaced GO-AROUND switch.
R On Capt AFCS MODES annunciator, GO ARND (aircraft without SB34-178) TO/GA (aircraft with SB34-178) message is displayed.

(5) Set FD A switch to OFF.

(6) Close circuit breaker A24 on panel CB1, and open circuit breaker A6 on panel CB1.



ZONE 210



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CAPTAINS CONTROL WHEEL
(FIRST OFFICERS OPPOSITE)

M1-0100-22-204

R Go Around Switch - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

(7) Set FD B switch to ON.

(8) On control wheel, depress replaced GO AROUND switch.
R On F/O AFCS MODES annunciator, GO ARND (aircraft
R without SB34-178) TO/GA (aircraft with SB34-178) message is displayed.

(9) Set FD B switch to OFF.

(10) Close circuit breaker A6 on panel CB1.

(11) Revert to 'on ground' condition by reversing ACTION taken in Step (2).

R ELECTRICAL PITCH TRIM GENERATOR - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R	20-00-05	Soldering Procedures and Requirements for the L-1011 Aircraft (Wiring Diagram Manual)
R	21-00-00	Air Conditioning System - Maintenance Practices
R	24-00-00	Electrical Power System - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 2. Equipment and Materials

R Adhesive, SM1484-05 (Lear Siegler, Inc), or equivalent

R Epoxy paint, 005-8295-010 (Collins), or equivalent

R 3. Removal/Installation

R WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R A. Removal

R (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

R AVIONICS FLIGHT CONTROL SYSTEM

R NO. 1 SYSTEMS

R PITCH & ROLL (A6)

R TRIM AGMT - AC (A7)

R TRIM AGMT - DC (A8)

R NO. 2 SYSTEMS

R PITCH & ROLL (A24)

R TRIM AGMT - AC (A25)

R TRIM AGMT - DC (A26)

(2) Locate electrical pitch trim generator on outboard side of control wheel, zone 210 (Ref. Fig. 401).

(3) Remove screws securing generator cover, and remove cover to expose generator wire connection. Retain screws and cover.

(4) Tag wires. Make note of wire coding and placement of wires.

(5) Unsolder wires to generator (Ref. Wiring Diagram Manual 20-00-05).

(6) Remove screws securing generator to control wheel. Retain screws.

R R CAUTION: DO NOT TWIST OR APPLY EXCESSIVE TENSION ON GO-AROUND SWITCH WIRING.

(7) Hold GO-AROUND switch from behind, and unscrew switch from switch shield.

(8) Remove generator.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

R R CAUTION: DO NOT TWIST OR APPLY EXCESSIVE TENSION ON GO-AROUND SWITCH WIRING.

(2) Apply adhesive on GO-AROUND switch threads, and screw switch into switch shield on new generator assembly by holding switch and rotating generator assembly (Ref. Fig. 401).

NOTE: GO-AROUND switch shield is pressed into generator assembly. If shield has rotated in process, rotate it so that the words GO-AROUND will face upward.

(3) Route generator wires through generator retainer.

(4) Position generator on control wheel and secure with screws.

(5) Solder wires to generator terminals as identified by tags during removal (Ref. Wiring Diagram Manual 20-00-05).

(6) Install generator cover and secure with screws.

(7) Touch up finish coat of generator mounting screws and generator cover mounting screws with black epoxy paint.

(8) Remove tags and close circuit breakers opened in Step 3A(1).

(9) Remove placards from hydraulic control panels.

(10) Perform operational test in Step C.

C. Operational Test

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-00-00).

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on one of hydraulic systems (Ref. 29-11-00).

(4) On FCES panel, verify that PITCH TRIM 1 and 2 switchlights are on (latched in).

(5) On replaced pitch trim generator, turn thumbwheel in both directions.

RESULT:

Control column moves in both directions with no PITCH TRIM FAIL light.

(6) On APFDS ENGAGE panel, set FD A switch to ON and FD B switch to OFF.

(7) On control wheel with pitch trim generator replaced, depress GO-AROUND switch.

RESULT:

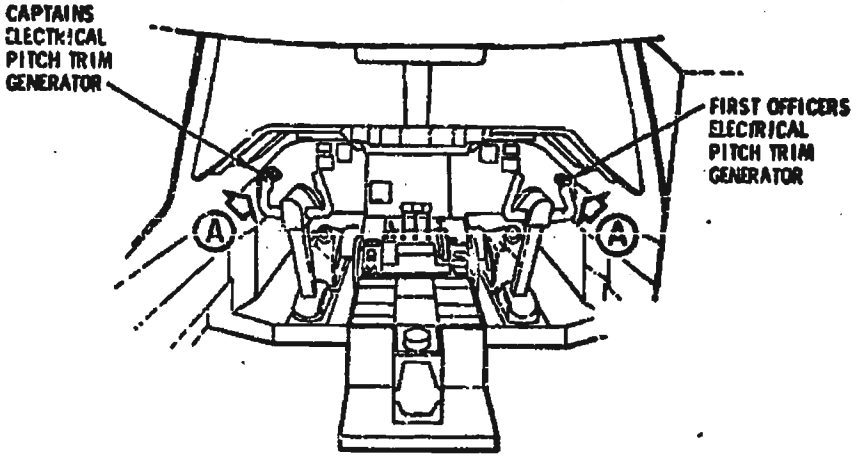
TAKEOFF message is displayed on AFCS MODES annunciators.

R (8) Set FD A switch to OFF, FD B switch to ON, and repeat
R GO-AROUND switch check.

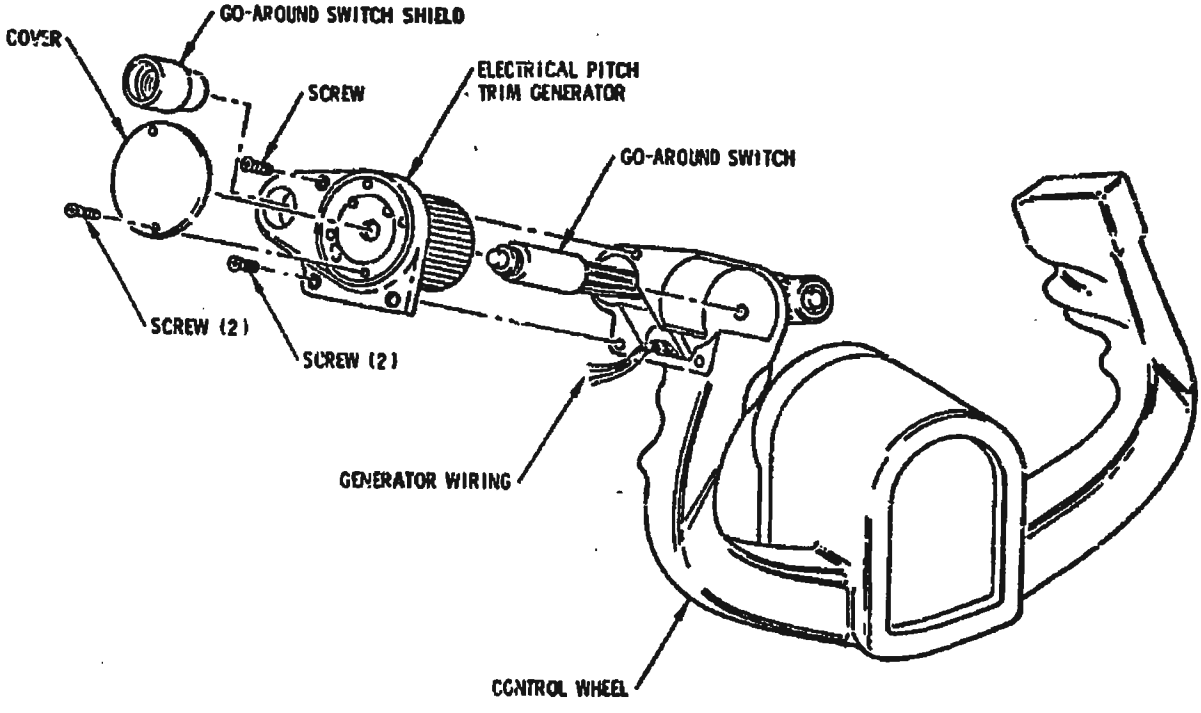
R (9) Set FD B switch to OFF.

R (10) Turn off hydraulic power (Ref. 29-11-00).

R (11) Turn off electrical power (Ref. 24-00-00).



ZONE 210



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CAPTAINS CONTROL WHEEL
(FIRST OFFICERS OPPOSITE)

M1-0100-22-294

R Electrical Pitch Trim Generator - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

R CONTROL WHEEL CABLE ASSEMBLY - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 21-00-00 Air Conditioning System - Maintenance Practices

R 22-12-00 APFDS Modes of Operation - Maintenance Practices

R 24-00-00 Electrical Power System - Maintenance Practices

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 2. Equipment and Materials

R Electrical Connector Wrench - PN 797-9712-001 (Collins)

R Connector Removal Tool - PN 426680 (LSI)

R Lockwire - Fed. Spec. QQ-W-390, Cond A, 0.002-inch dia. or
R equiv.

R Sealing Compound - MIL-S-22473 - Grade E, (Loctite) or equiv.

R 3. Removal/Installation

R WARNING: ALL FOUR HYDRAULIC SYSTEMS MUST BE SHUT OFF (29-11-00)
R AND PLACARDED AT FLIGHT ENGINEER/SECOND OFFICER
R HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC
R SERVICE PANEL, ZONE 147.

R A. Removal

R (1) On pilot overhead circuit breaker panel CB1, zone 210,
R open and tag the following circuit breakers:

R AVIONICS FLIGHT CONTROL SYSTEM

R NO. 1 SYSTEMS

R PITCH & ROLL (A6)

R TRIM AGMT AC (A7)

R TRIM AGMT DC (A8)

R AUDIO CONTROL

R CAPT & F/E (A12)

R EFFECTIVITY: ALL
R
0018

F/O & OBS (A13)

NO. 2 SYSTEMS

PITCH & ROLL (A24)

TRIM AGMT AC (A25)

TRIM AGMT DC (A26)

On Flight Engineer/Second Officer aft circuit breaker panel CB3, zone 215, open and tag the following circuit breakers:

AUDIO CONT

CAPT & F/E (C16)

F/O & OBS (C17)

FLT INTPH AMPL (C18)

(2) Press MIC SEL INT switch on captain and first officer audio selector panels on center console and placard panels to prevent inadvertent operation of the selector switches.

(3) Loosen setscrew at base of control wheel hub and remove cover (See Figure 401).

(4) Remove lock-wire from connector plus P3.

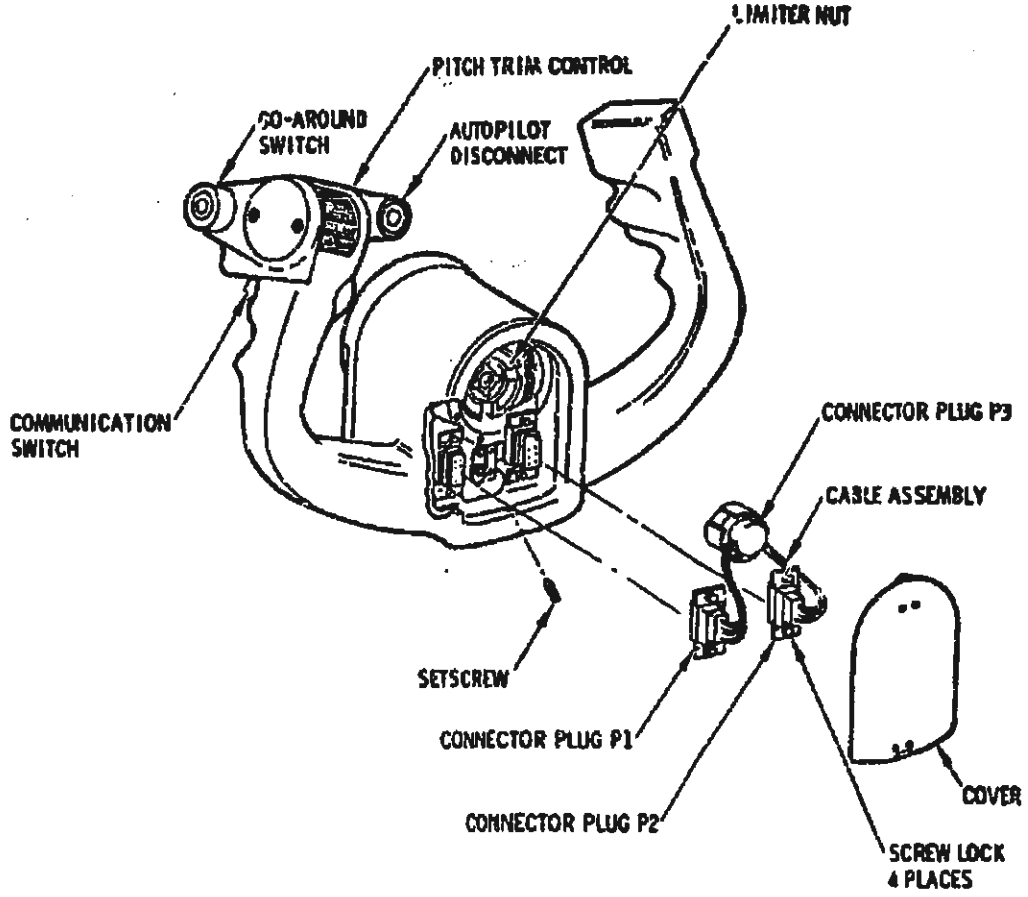
(5) Loosen screw locks evenly on plus P1 and then on P2.

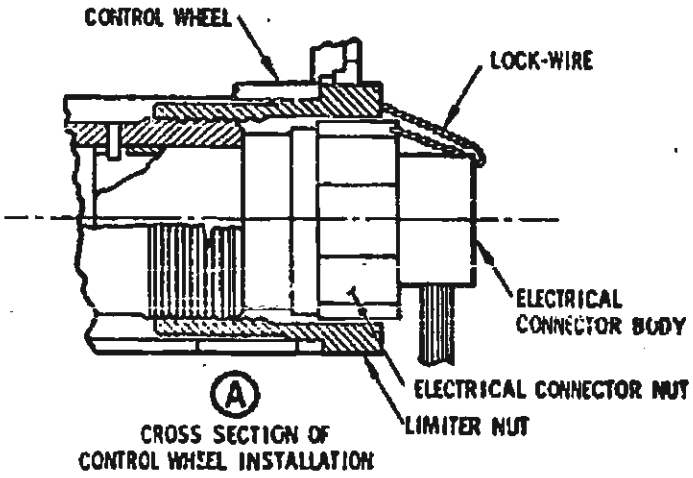
R CAUTION: TO PREVENT DAMAGE TO CABLE ASSEMBLY WIRING AND TO CONNECTOR PINS, CABLE ASSEMBLY WIRES MUST NOT BE PULLED TO DISCONNECT P1 AND P2. CONNECTOR PLUGS MUST NOT BECOME COCKED DURING REMOVAL.

(6) Position connector removal tool (PN 426680) under connector receptacle P1 as shown in Figure 402. Disconnect P1 from J1 by applying pulling pressure simultaneously to both ends of P1 with the removal tool.

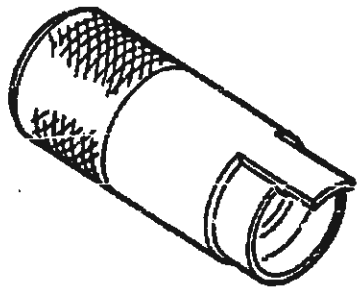
(7) Repeat Step (6) procedure to disconnect P2 from J2.

R CAUTION: TO PREVENT DAMAGE TO CABLE ASSEMBLY WIRES, CONNECTOR WRENCH MUST BE INSERTED ONLY IN THE UPPER QUADRANT OF CONNECTOR NUT.





CROSS SECTION OF CONTROL WHEEL INSTALLATION



ELECTRICAL CONNECTOR WRENCH (COLLINS PN 797-9712-001)

M1-0000-22-1966

R R Control Wheel Cable Assembly - Removal and Installation
Figure 401

R R EFFECTIVITY: ALL

0018

(8) Remove connector plug (P3) using connector wrench (PN 797-9712-001).

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are opened and tagged.

R CAUTION: TO PREVENT DAMAGE TO CABLE ASSEMBLY, WIRES MUST NOT BE BENT OR STRESSED AND CONNECTOR WRENCH MUST BE INSERTED ONLY IN UPPER QUADRANT OF CONNECTOR NUT TO TORQUE CONNECTOR NUT FINGER-TIGHT.

(2) Install connector plug P3 using connector wrench (PN 797-9712-001) and torque to 10-20 lb. in. (finger tight).

R CAUTION: TO PREVENT DAMAGE TO CABLE ASSEMBLY WIRING AND TO CONNECTOR PINS, CABLE ASSEMBLY WIRES MUST NOT BE BENT AND PLUGS MUST NOT BECOME COCKED DURING INSTALLATION.

(3) Install connector plug P1 to receptacle J1 applying equal pressure simultaneously to both ends of P1.

(4) Tighten screw locks evenly on connector plug P1 and then on P2.

(5) Install lock-wire between connector nut, connector body, and limiter nut as shown in Figure 401.

(6) Install cover on control wheel opening and after threads are treated with sealing compound, secure set screw to retain cover.

(7) Remove tags and close circuit breakers opened in Step 3A(1).

(8) Remove placards for hydraulic controls at Flight Engineer/Second Officer panel, zone 215, and hydraulic service panel, zone 147.

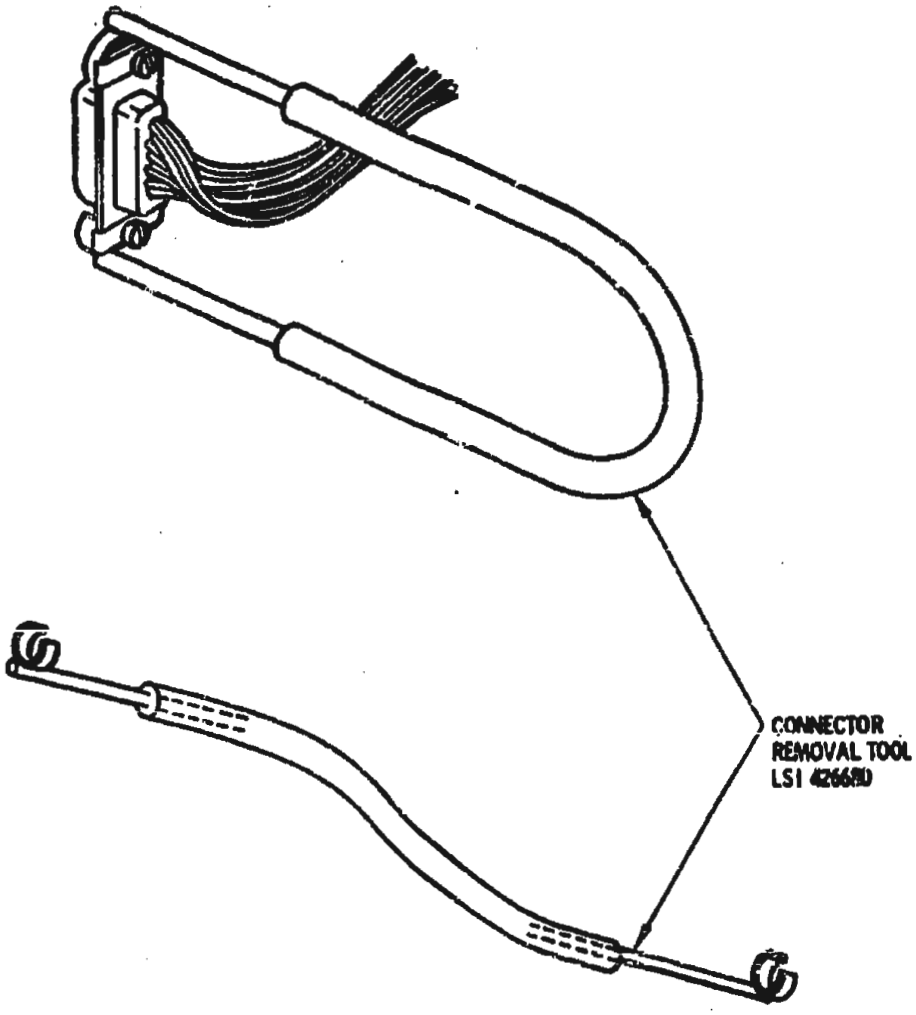
(9) Perform operational checkout procedure in Step 4.

4. Control Wheel Cable Assembly Checkout

A. Preliminary

(1) Turn on electrical power (24-41-00).

(2) Verify that the following systems are on:



M2-0000-22-1967

R Control Wheel Connectors P1 and P2 Removal Tool
R Figure 402

Avionics cooling (21-00-00)

Air Data Computer System (34-14-00)

Attitude Reference System (34-21-00)

Magnetic Heading Reference System (34-22-00)

Inertial Navigation System (34-43-00)

WARNING: DO NOT ENGAGE AUTOPILOT WHILE AIRCRAFT IS ON JACKS.

VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

PITCH TRIM WHEEL IS AT ZERO DEGREES.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

PERSONNEL AND GROUND EQUIPMENT ARE CLEAR OF ALL FLIGHT CONTROL SURFACES AND GEAR DOOR TRAVEL AREAS.

THE AFFECTED HYDRAULIC SYSTEM CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A and B (29-11-00).

B. Checkout go-around switch, disengage switch and force sensors.

(1) On autopilot glareshield panel, set FD switches A and B to ON.

(2) On control wheel under test, momentarily press go-around switch. Observe; AFCS modes annunciators
R TAKEOFF (aircraft without SB34-178) TO/GA (aircraft
R with SB34-178) message is displayed.

(3) On autopilot glareshield panels set bat handle A to CWS. Observe; bat handle will go to, and remain at, CWS position.

(4) Slowly pull control wheel aft with increasing force until high resistance to further motion is felt. Observe; bat handle remains at CWS position.

(5) Slowly release force on control wheel.

(6) Slowly rotate control wheel clockwise until high resistance to further motion is felt. Observe; bat handle remains at CWS position.

(7) Slowly release force on control wheel. If engage bat handle resets to OFF, set to CWS.

(8) On control wheel, momentarily press autopilot disconnect switch. Observe; that engage bat handle A resets to OFF.

(9) On autopilot glareshield panel, set bat handle B to CWS. Observe; that bat handle B goes to, and remains at, CWS position.

(10) On control wheel, momentarily press autopilot disconnect switch. Observe that bat handle B resets to OFF.

C. Checkout pitch trim control operation.

(1) On overhead FCES panel, press PITCH TRIM 1 to on and press PITCH TRIM 2 to off. Observe; PITCH TRIM 2 - OFF switchlight goes on.

(2) Verify that autopilot engage bat handles A and B are set to OFF.

(3) On control wheel, rotate pitch trim control thumbwheel. Observe; on center console, manual pitch trim wheel moves in appropriate direction.

R (4) On overhead FCES panel, press PITCH TRIM 2 to on and
R press PITCH TRIM 1 to off. Observe; PITCH TRIM 1 - OFF switchlight goes on.

(5) Repeat Steps 2 and 3.

D. Checkout communications (23-00-00) switch operation as follows:

(1) On Captain/First Officer audio selector panel, press MIC SEL - INT, and INT switch. Position OXY/BOOM switch to OXY.

(2) On control wheel, press communications switch and speak into oxygen mask microphone. Observe; headset audio is heard (adjust volume as necessary).

(3) After test return communication switches to normal ground condition.

R D. Checkout completion

R (1) Turn off hydraulic power (29-11-00).

R (2) Turn off all systems turned on in Step 4(2).

R (3) Turn off electrical power (24-41-00).

R

FD BASIC MODE - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting FD basic mode faults are included in this section of the manual. FD basic mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This report and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use FD basic mode fault matrix.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Identification

R Table 101 is a list of the FD basic mode fault isolation diagrams and schematics. Figure 101 and 102 provide component location for FD basic mode troubleshooting.

R A. General

R FD basic mode fault isolation contains two levels of troubleshooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation trouble shoots a specific FD basic mode problem. System oriented fault isolation (Ref. 22-10-31, Page 501) tests and trouble shoots FD basic mode problems.

R B. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the FD basic mode by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-10-31, Page 501) to isolate problem.

R Figures 104 and 105 provide diagnostic steps to further
R isolate the fault. The diagnostic steps are in a flow chart
R form which contains complete fault isolation procedures for
R each fault. Action instructions are contained within the
R blocks of the flow chart while the monitored results of the
R actions are outside the blocks. When using the flow charts,
R it is assumed that systems are in the normal operational
R mode, all relevant circuit breakers have been checked, and
R all applicable aircraft operational procedures have been
R accomplished.

Fault Isolation Diagram and Schematic List
Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	FD Basic Mode Fault Matrix
104	FD Turned-Off Faults
105	FD Basic Mode Faults
106	FD Basic Mode Logic
107	FD Basic Mode Signal Flow
22-11-00 SCHEM 5	Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic
22-11-00 SCHEM 6	Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic
22-11-00 SCHEM 8	FD Engage Logic Schematic
22-11-00 SCHEM 13	Turbulence, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic Schematic
22-13-00 SCHEM 4	Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic
22-13-00 SCHEM 5	Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic
22-13-00 SCHEM 8	HDG SEL, HDG HOLD, Capture, A/L TRK-B and R-NAV Mode Engage Logic Schematic
22-13-00 SCHEM 13	Roll Command Enable and FD Valid Logic Schematic

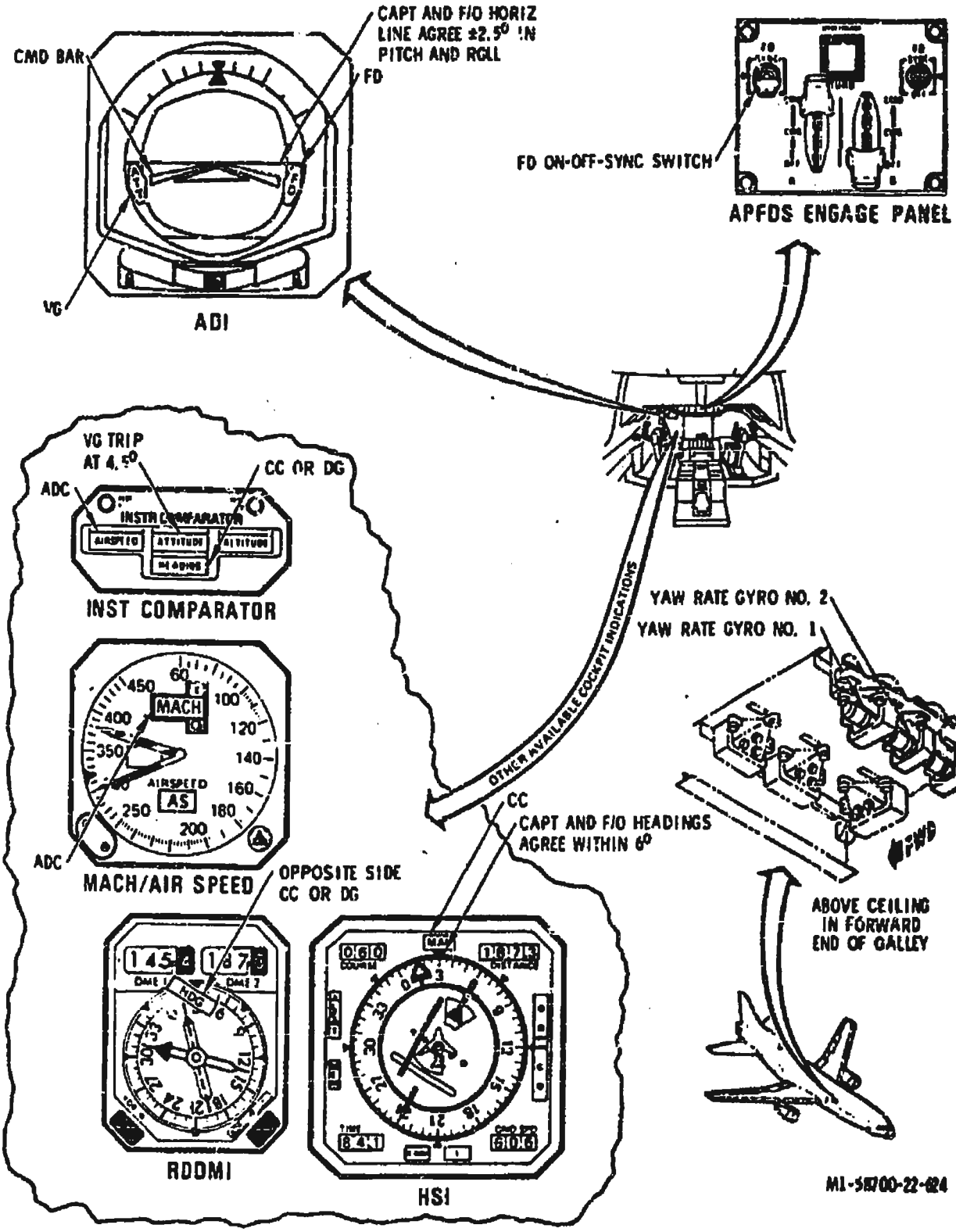
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCESSORY UNIT – HEADING COUPLER	1	FESC, REAR RACK/112AB	34-22-06
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
COUPLER – COMPASS	2	FESC, REAR RACK/112AB	34-22-03
GYRO – DIRECTIONAL	2	FESC, GYRO RACK/112AB	34-22-04
GYRO – YAW RATE	3	GALY CLG/135DB	22-15-02
GYRO – VERTICAL ATTITUDE REFERENCE	3	FESC, FWD RACK/112AB	34-21-04
INDICATOR – ATTITUDE DIRECTOR	2	FLT STA, CAPT AND F/O INSTR PNL	34-21-07
PANEL – APFDS ENGAGE	1	FLT STA, GLRSHLD PNL	22-10-01
UNIT – INERTIAL NAVIGATION [1]	3	FESC, FWD RACK/112AB	34-43-03

[1] EFFECTIVITY
INS EQUIPPED AIRCRAFT

M1-0000-22-2115

R R Component Location Index
Figure 101

R R 0018 EFFECTIVITY: ALL



R Component Locator Diagram Figure 102 (Sheet 1)

R EFFECTIVITY: ALL

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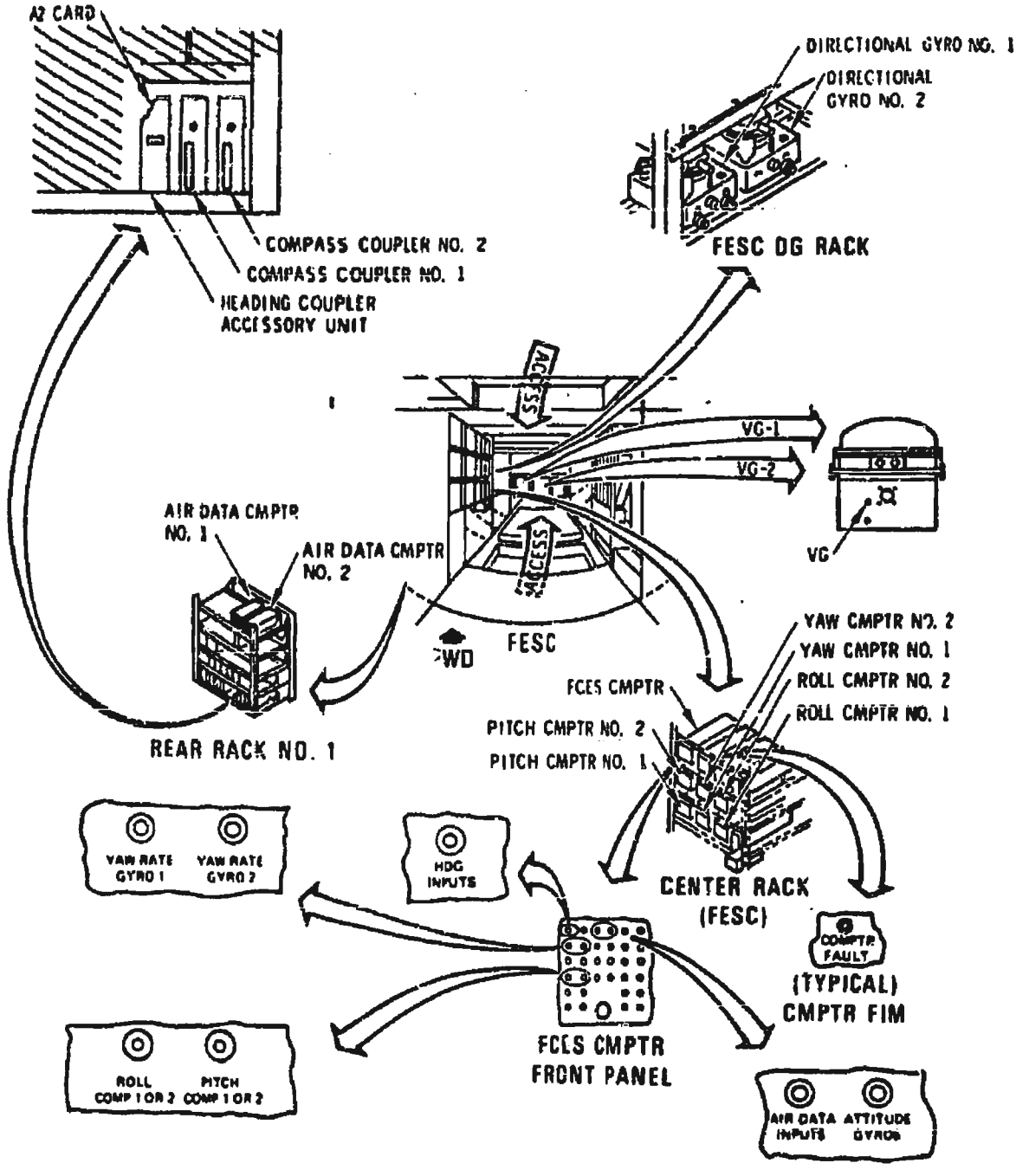

MI-0001-22-626

R Component Locator Diagram
R Figure 102 (Sheet 2)

R EFFECTIVITY: ALL
R
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FAULTS		FIM								NO FIM		
No.	Problem (Capt or F/O) Capt FIRM Codes With -1 — F/O FIRM Codes With -2 X — Use With Both FIRM Codes	Troubleshooting Faulty LRU Check FIM on LRU or on Front Panel of FCES Cmptr RC	PC	YC	YRG	VG	OC	DG	ADC	Continuity Check or Replace ADI	HCAU	APFDS ENG PNL
"BOTH FD OFF AND BOTH AP OFF" (Ref. Fig. 104)												
1	FD flag in view and CMD bar in view on ADI									C/F		
2	FD flag in view on ADI									C/F	X	X
3	CMD bar in view on ADI	1/2										
"BOTH FD ON AND BOTH AP OFF" (Ref. Fig. 105)												
11	FD flag in view, CMD bar out of view, ATT flag in view on ADI. AP (same side) will not engage.					1/2						
12	FD flag in view, CMD bar out of view on ADI. HDG flag in view on HSI (same side) and on RDDMI (opposite side). AP (same side) will not engage						1/2	1/2				
13	FD flag in view, CMD bar out of view on ADI. MACH flag in view on AS/MACH ind (same side). SSC flag in view on Baro Alt (same side). AP (same side) locked out of CMD.								1/2			
14	FD flag in view, CMD bar out of view on ADI. AP (same side) can be engaged in CMD.	1/2	1/2							C/F	X	
15	FD flag in view, CMD bar out of view on ADI. AP (same side) will not engage	1/2	1/2			1/2	1/2					
16	FD flag in view, CMD bar out of view on ADI. AP (same side) locked out CMD	1/2										
17	ADI CMD bar does not follow other ADI bar in pitch	1/2				1/2						
18	ADI CMD bar does not follow other ADI bar in roll when A/C roll is less than 3 deg. Sys normal when A/C roll is 3 deg and FD is synced	1/2	1/2	1/2	1/2		1/2		1/2			
19	ADI CMD bar does not follow other ADI bar in roll.	1/2				1/2						
20	FD flag in view on ADI and CMD bar does not follow other ADI bar in pitch.		1/2							C/F	X	
21	FD flag in view on ADI and CMD bar does not follow other ADI bar in roll.	1/2								C/F	X	
22	FD flag jitters in and out of view on ADI									C/F		
23	CMD bar will not sync to new attitude on ADI with one FD sw.											X
24	CMD bar will not sync to new attitude on ADI with either FD sw.	1/2	1/2									X

M1-0002-22-630

R FD Basic Mode Fault Matrix
R Figure 103 (Sheet 1)

R EFFECTIVITY: ALL

Abbreviations		Remove and Install Ref.	
		Chapt	Page
ADC	Air Data Computer	34-14-01	401
ADI	Attitude Director Indicator	34-21-07	401
APFDS ENG PNL	APFDS Engage Panel	22-10-01	401
CC	Compass Coupler	34-22-03	401
DG	Directional Gyro	34-22-04	401
HCAU	Heading Coupler Accessory Unit	34-22-08	401
INU	Inertial Navigation Unit	34-43-03	401
ISU	Inertial Sensor Unit	34-43-03	401
PC	Pitch Computer	22-11-01	401
RC	Roll Computer	22-13-01	401
VG	Vertical Gyro or	34-21-04	401
	Inertial Navigation Unit or	34-43-03	401
	Inertial Sensor Unit	34-43-03	401
YC	Yaw Computer	22-15-01	401
YRG	Yaw Rate Gyro	22-15-02	401
X	One LRU Common to Both Sys		
1	No. 1 LRU Associated With Sys 1 Problem		
2	No. 2 LRU Associated With Sys 2 Problem		

HOW TO USE

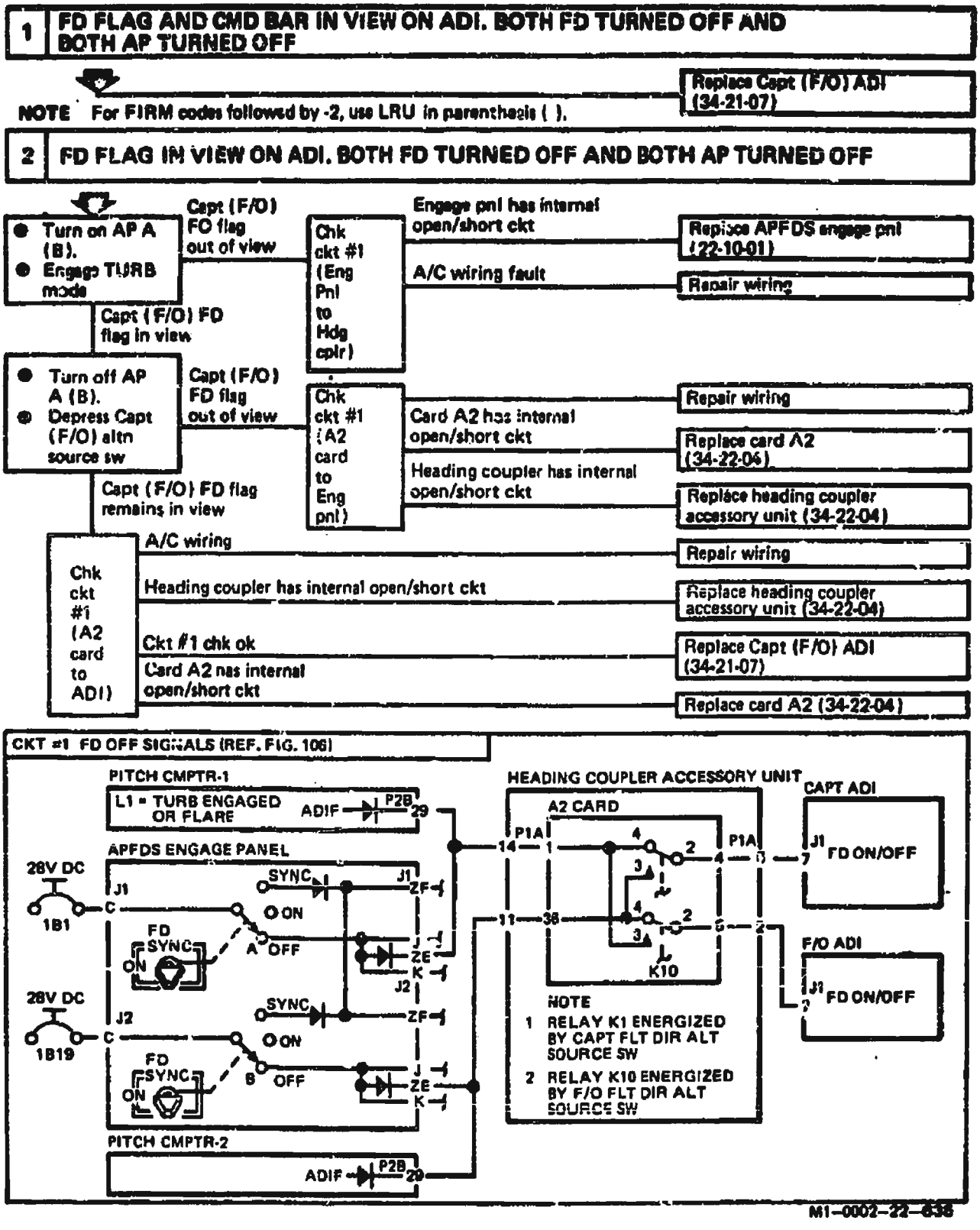
1. Find flight squawk in FAULTS column
2. Check FIM or LRU listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 and 105

M1-0102-22-834

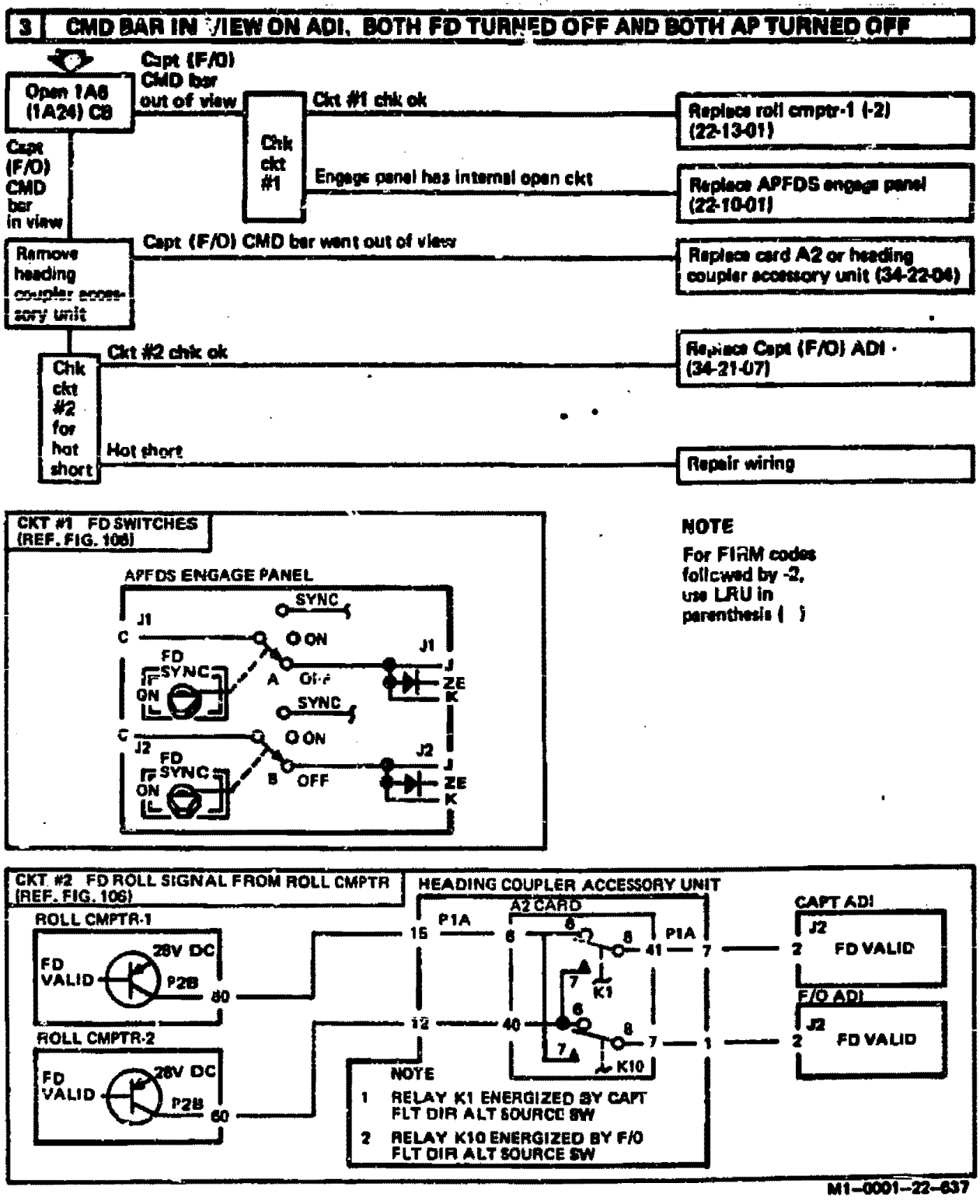
FD Basic Mode Fault Matrix
Figure 103 (Sheet 2)

EFFECTIVITY: ALL

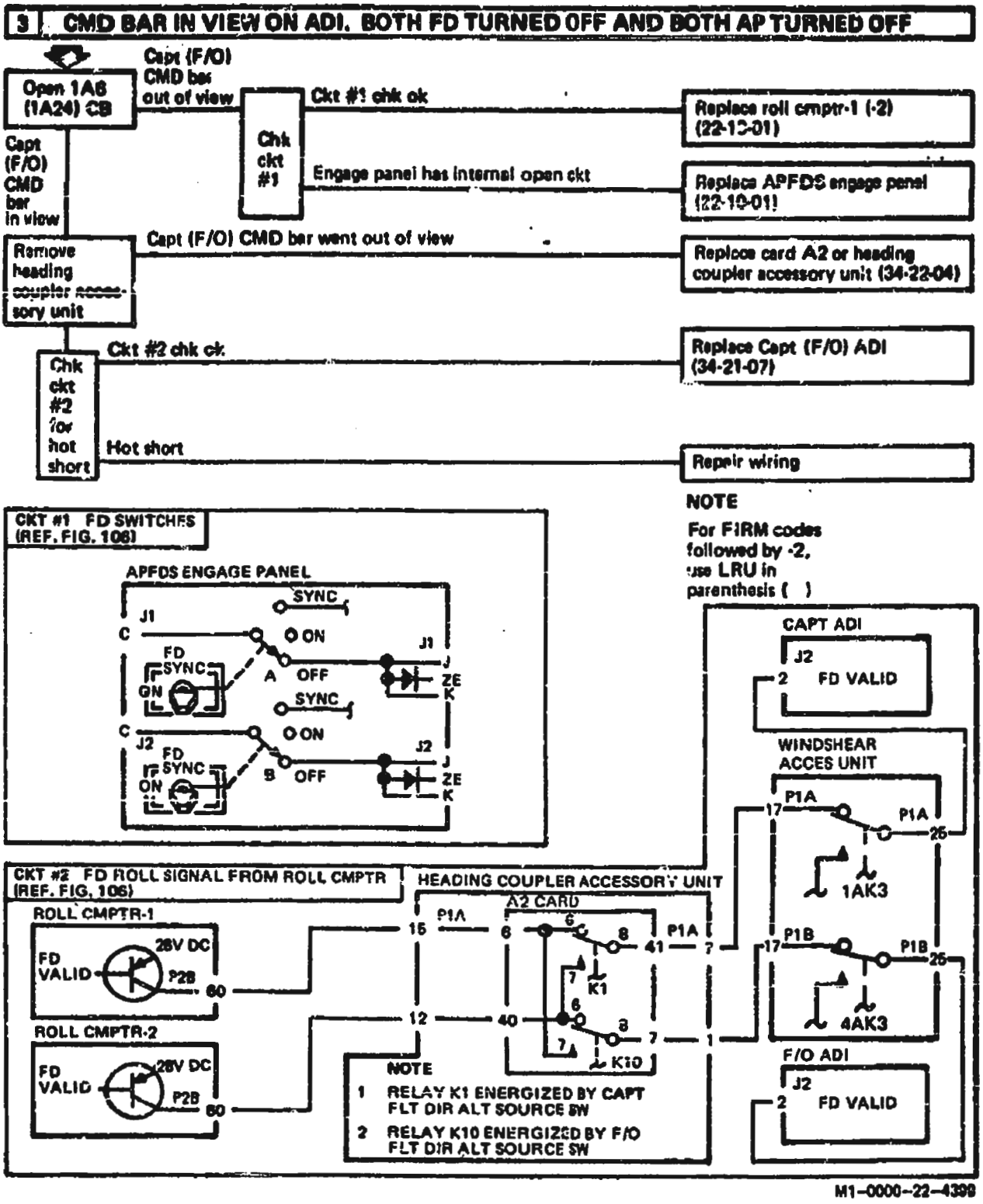
001B



R FD Turned-Off Faults
R Figure 104 (Sheet 1)



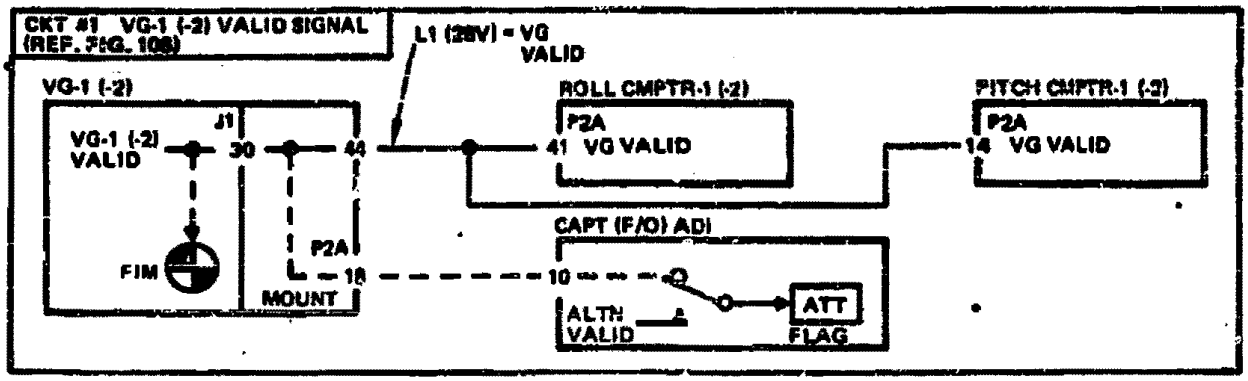
FD Turned-Off Faults
Figure 104 (Sheet 2)



R FD Turned off Faults
R Figure 104 (Sheet 2)

11 FD FLAG IN VIEW, CMD BAR OUT OF VIEW, AND ATT FLAG IN VIEW ON ADI. AP (SAME SIDE) WILL NOT ENGAGE. BOTH FD TURNED ON

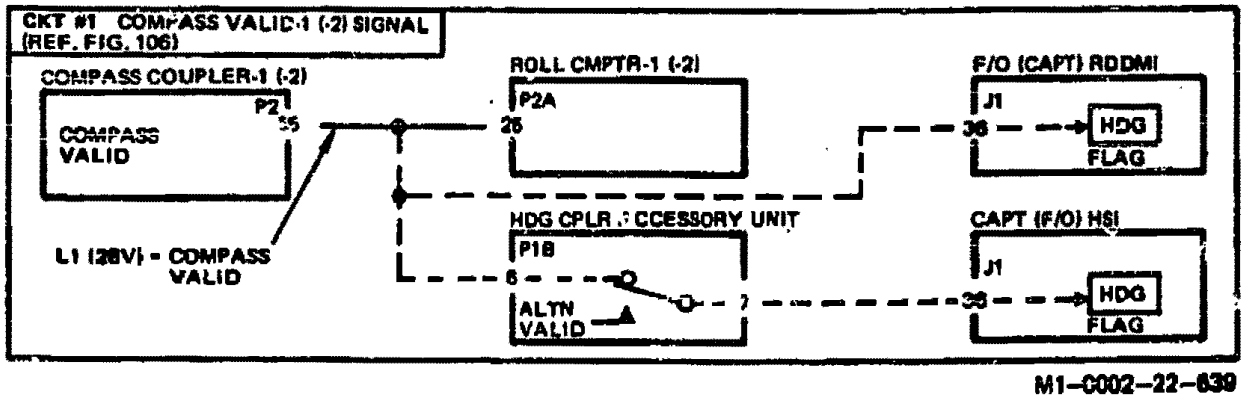
Loss of VG-1 (-2) valid signal (Ref. Ckt #1) → Replace VG-1 (-2) (34-21-04)



NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( )

12 FD FLAG IN VIEW, CMD BAR OUT OF VIEW ON ADI. HDG FLAG IN VIEW ON HSI (SAME SIDE) AND ON RDDMI (OPPOSITE SIDE). AP (SAME SIDE) WILL NOT ENGAGE

Chk cmps cplr-1 (-2) FIM
- Yel → Replace cmps cplr-1 (-2) (34-22-02)
- Blk → Chk DG-1 (-2) FIM
  - Yel → Replace DG-1 (-2) (34-22-04)
  - Blk → Chk ckt #1
    - Ckt #1 chk ok → Replace cmps cplr-1 (-2) (34-22-02)
    - A/C wiring fault → Repair wiring

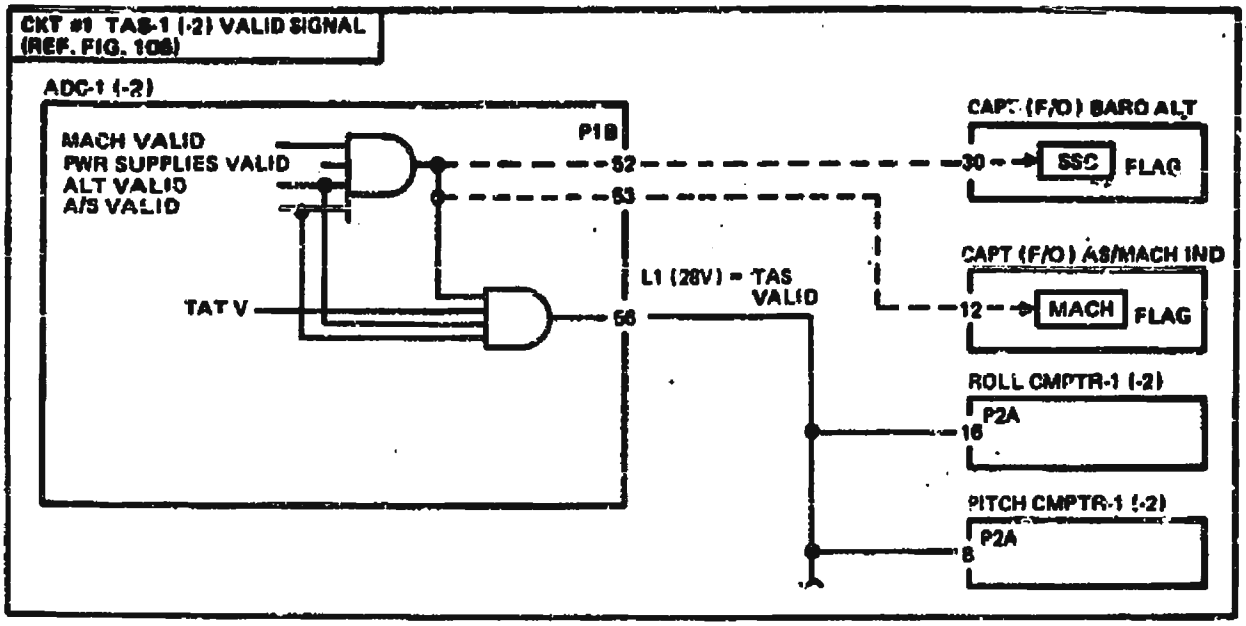


M1-C002-22-639

FD Basic Mode Faults
Figure 105 (Sheet 1)

13	FD FLAG IN VIEW, CMD BAR OUT OF VIEW ON ADI. MACH FLAG IN VIEW ON AS/MACH IND (SAME SIDE). SSC FLAG IN VIEW ON BARO ALT (SAME SIDE). AP (SAME SIDE) LOCKED OUT OF CMD. BOTH FD TURNED ON

Loss of TAS-1 (-2) valid signal (Ref. Ckt #1) → Replace ADC-1 (-2) (34-14-01)



NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( )

M1-0101-22-043

FD Basic Mode Faults
Figure 105 (Sheet 2)

14 FD FLAG IN VIEW, CMD BAR OUT OF VIEW ON ADI. AP (SAME SIDE) CAN BE ENGAGED IN CMD. BOTH FD TURNED ON

Depress FLT DIR altn source sw (same side)

Fault goes away

Fault remains

Chk ckt #1 (Hdg cplr to pitch cmptr)

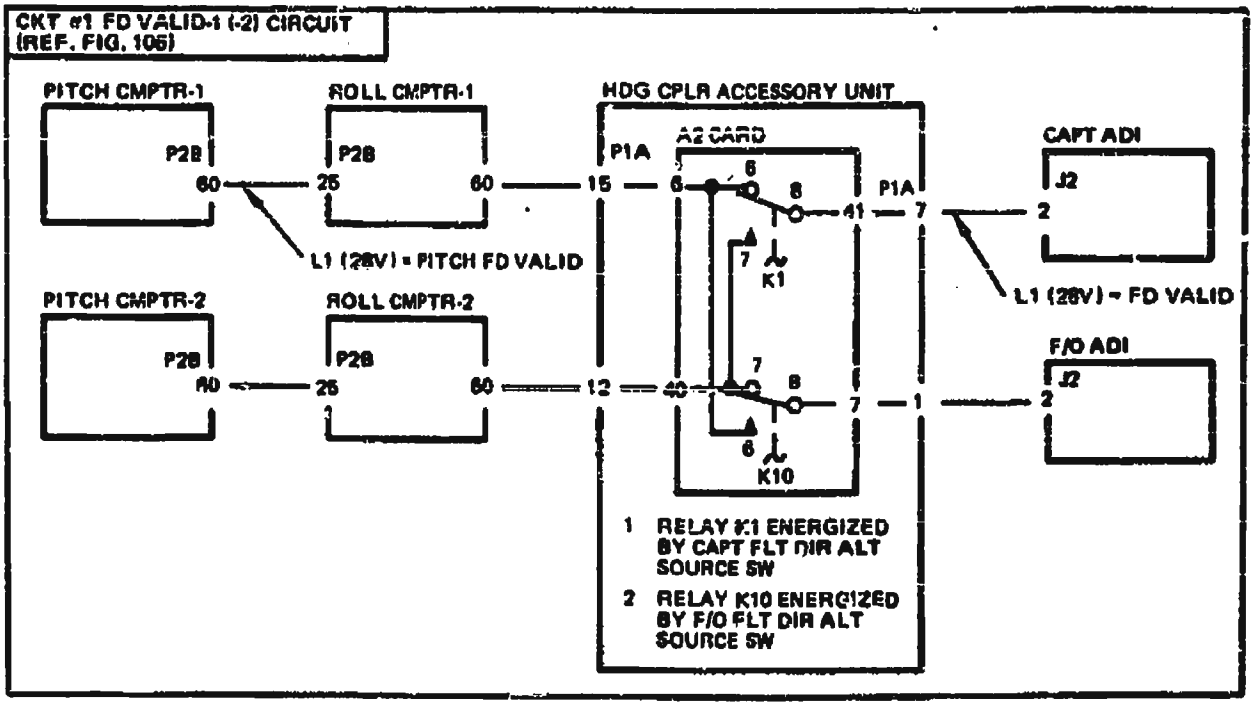
- Ckt #1 chk ok → • Replace pitch cmptr-1 (-2). (22-11-01). • If problem persists, replace roll cmptr-1 (-2) (22-13-01)
- Heading coupler has internal open ckt → Replace heading coupler accessory unit (34-22-04)
- A/C wiring fault → Repair wiring

Chk ckt #1 (Hdg cplr to ADI)

- Ckt #1 chk ok → Replace Capt (F/O) ADI (34-21-07)
- Heading coupler has internal open ckt → Replace heading coupler accessory unit (34-22-04)
- A/C wiring fault → Repair wiring

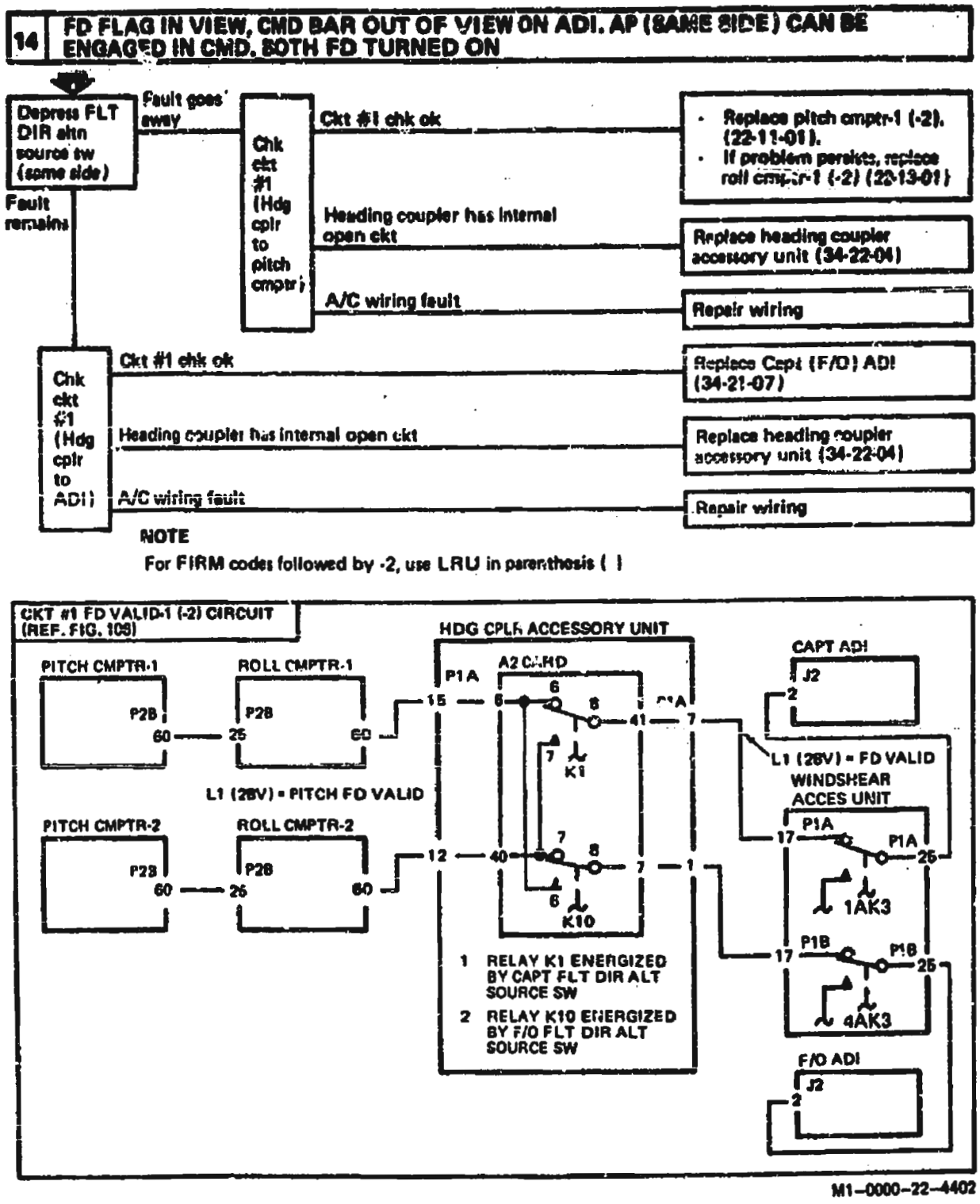
NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( )

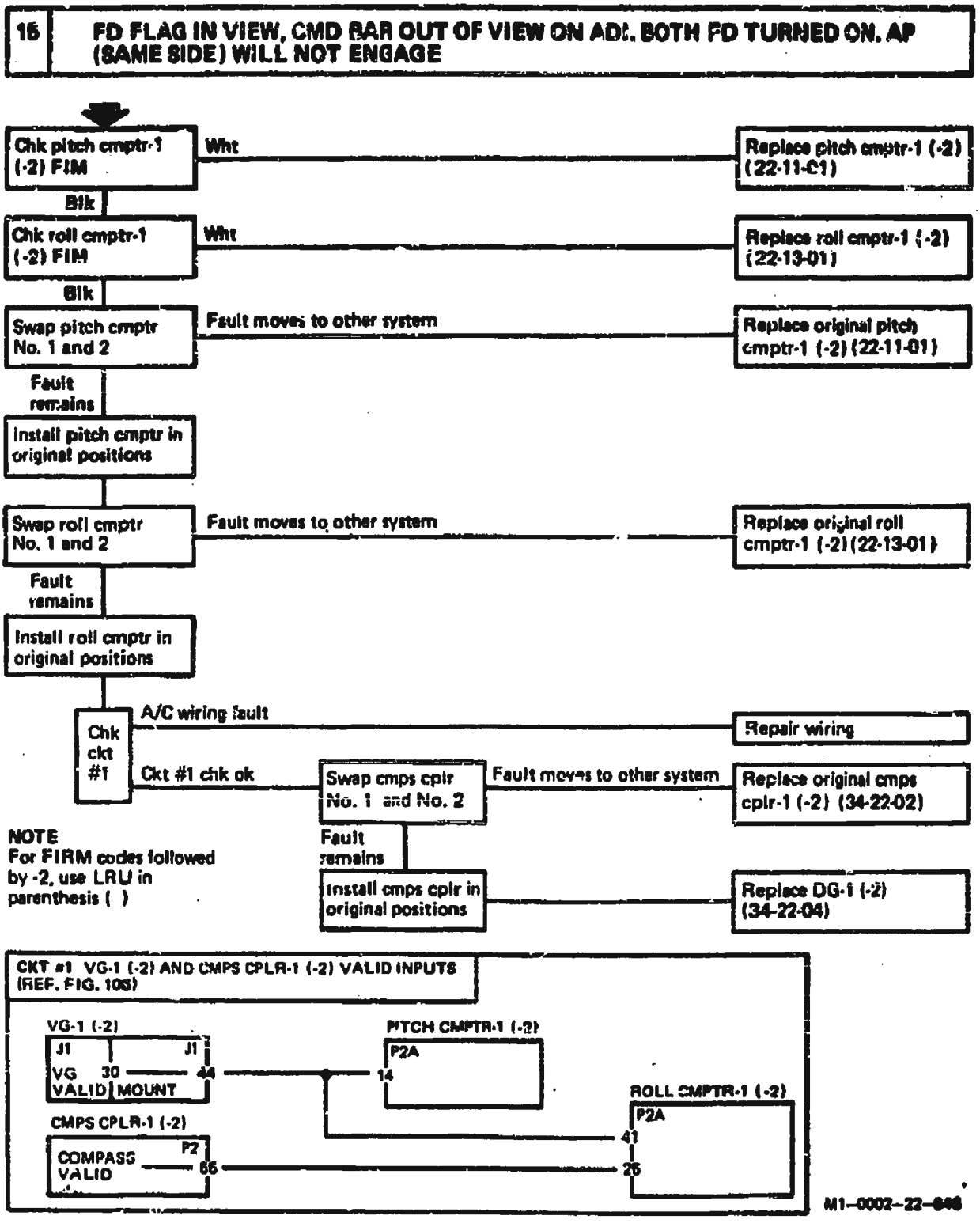


M1-0001-22-844

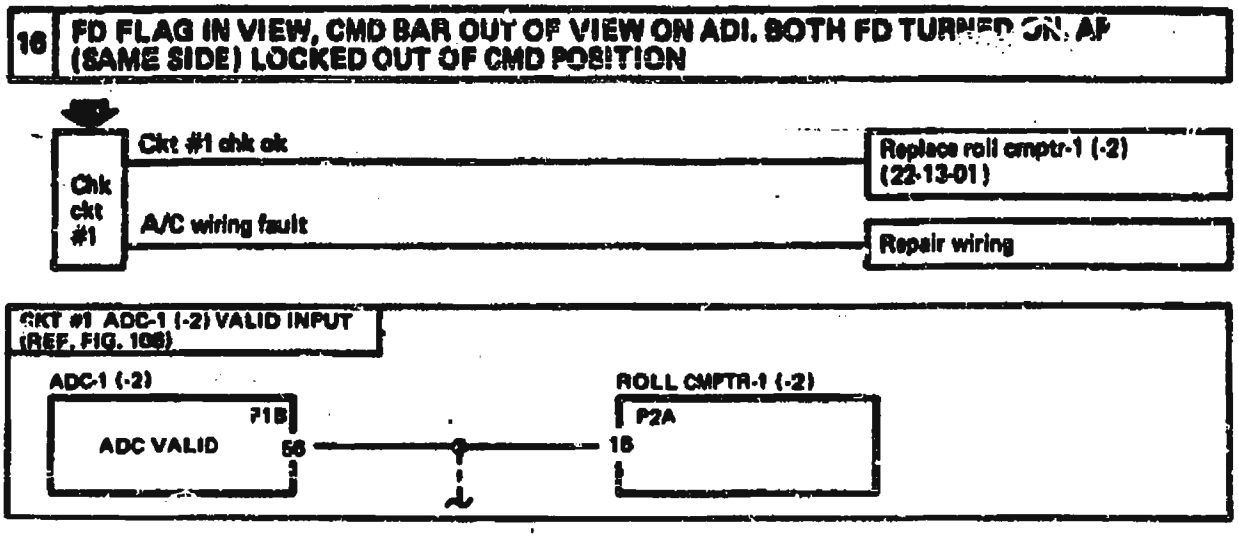
FD Basic Mode Faults
Figure 105 (Sheet 3)


14
FD FLAG IN VIEW, CMD BAR OUT OF VIEW ON ADI. AP (SAME SIDE) CAN BE ENGAGED IN CMD. BOTH FD TURNED ON
Depress FLT DIR altn source sw (same side)
Fault goes away
Fault remains
Chk ckt #1 (Hdg cplr to pitch cmptr)
Ckt #1 chk ok
Heading coupler has internal open ckt
A/C wiring fault
Replace pitch cmptr-1 (-2). (22-11-01).
If problem persists, replace roll cmptr-1 (-2) (22-13-01)
Replace heading coupler accessory unit (34-22-04)
Repair wiring
Chk ckt #1 (Hdg cplr to ADI)
Ckt #1 chk ok
Heading coupler has internal open ckt
A/C wiring fault
Replace Capt (F/O) ADI (34-21-07)
Replace heading coupler accessory unit (34-22-04)
Repair wiring
NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( )

R FD Basic Mode Faults
R Figure 105 (Sheet 3)



FD Basic Mode Faults
Figure 105 (Sheet 4)


16
FD FLAG IN VIEW, CMD BAR OUT OF VIEW ON ADI. BOTH FD TURNED ON. AP (SAME SIDE) LOCKED OUT OF CMD POSITION
Chk ckt #1
Ckt #1 chk ok
Replace roll cmptr-1 (-2) (22-13-01)
A/C wiring fault
Repair wiring
CKT #1 ADC-1 (-2) VALID INPUT (REF. FIG. 106)
ADC-1 (-2)
J1B
ADC VALID
56
ROLL CMPTR-1 (-2)
P2A
16

NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( )

M1-0101-22-648

FD Basic Mode Faults
Figure 105 (Sheet 5)

17 ADI CMD BAR DOES NOT FOLLOW OTHER BAR IN PITCH, BOTH FD TURNED ON

On FCES cmptr:
- Chk pitch ccmp 1 or 2 FIM

Yel → Replace pitch cmptr-1 (-2) (22-11-01)

Blk

On FCES cmptr:
- Chk attitude gyros FIM

Yel → Chk ckt #1

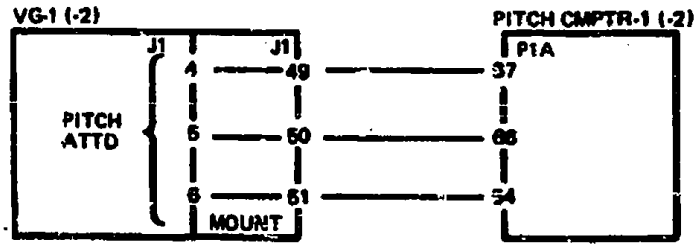
Chk ckt #1 → Ckt #1 chk ok
- Replace VG-1 (-2) (34-21-04).
- If problem persists, replace pitch cmptr-1 (-2) (22-11-01)

Chk ckt #1 → A/C wiring fault → Repair wiring

Blk → Replace pitch cmptr-1 (-2) (22-11-01)

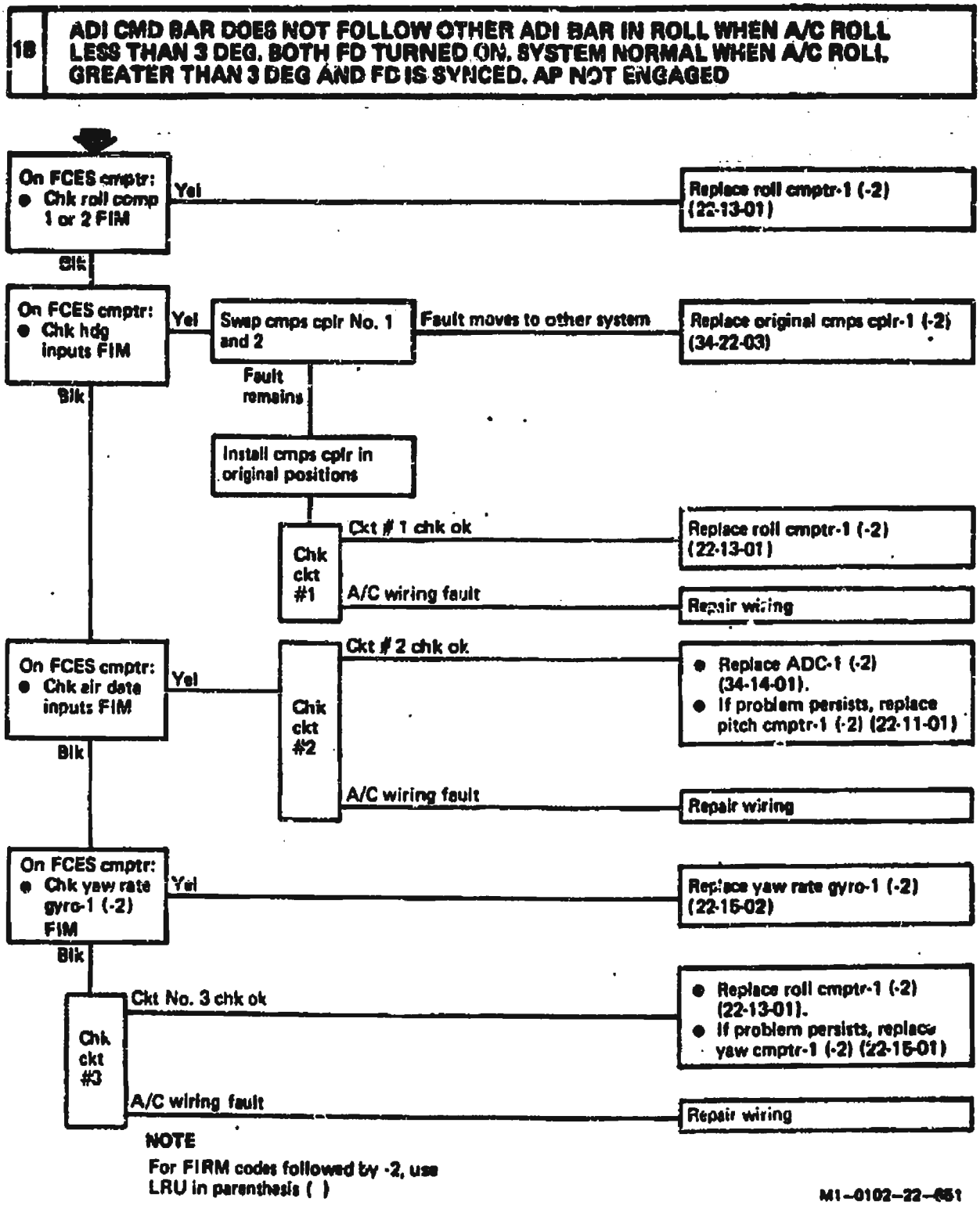
NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( )

CKT #1 VG-1 (-2) ANALOG SIGNAL (REF. FIG. 107)



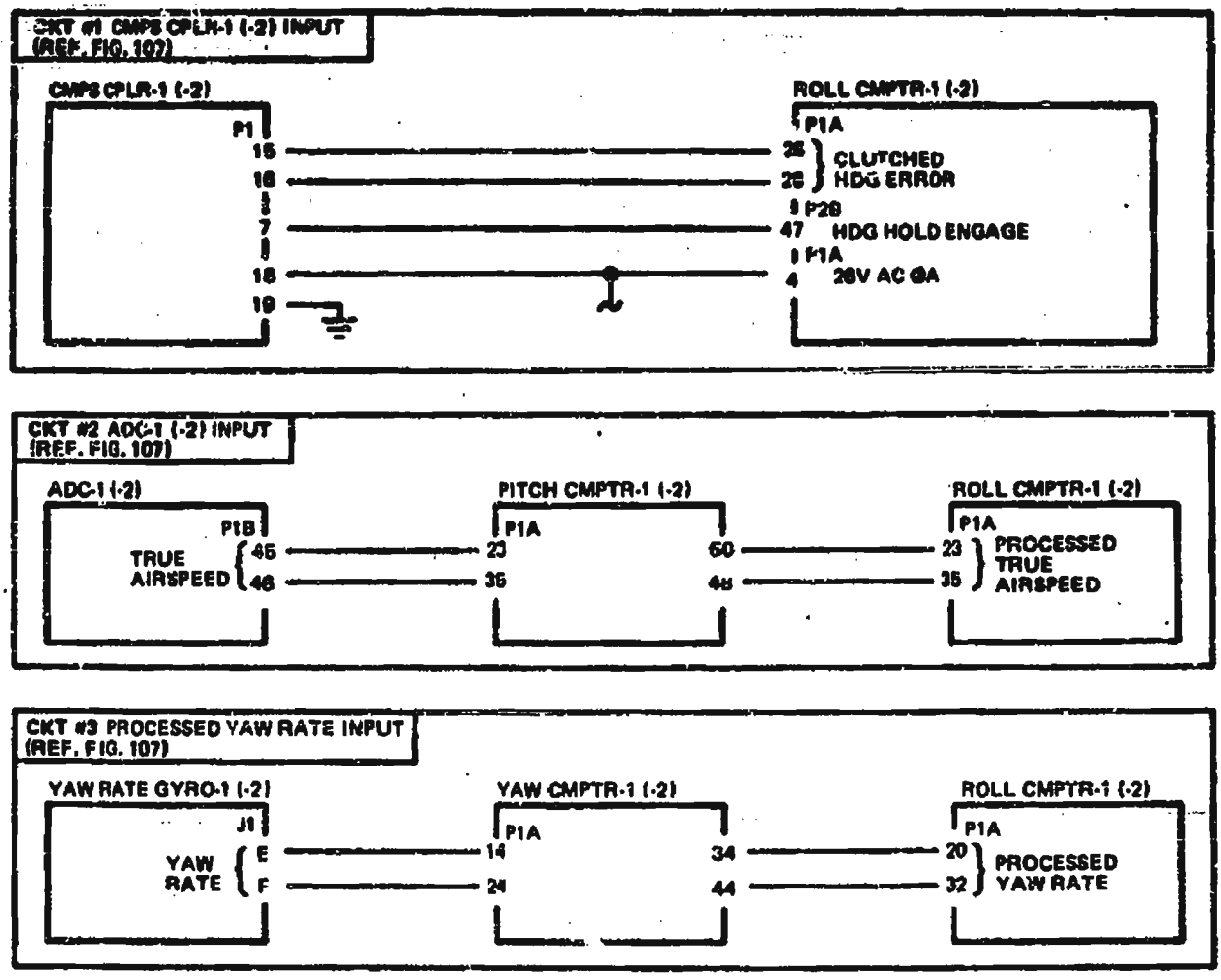
M1-0001-22-640

FD Basic Mode Faults
Figure 105 (Sheet 6)


18
ADI CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN ROLL WHEN A/C ROLL LESS THAN 3 DEG. BOTH FD TURNED ON. SYSTEM NORMAL WHEN A/C ROLL GREATER THAN 3 DEG AND FD IS SYNCED. AP NOT ENGAGED
On FCES cmptr:
• Chk roll comp 1 or 2 FIM
Yes
Replace roll cmptr-1 (-2) (22-13-01)
Blk
On FCES cmptr:
• Chk hdg inputs FIM
Yes
Swap cmps cplr No. 1 and 2
Fault moves to other system
Replace original cmps cplr-1 (-2) (34-22-03)
Blk
Fault remains
Install cmps cplr in original positions
Chk ckt #1
Ckt # 1 chk ok
Replace roll cmptr-1 (-2) (22-13-01)
A/C wiring fault
Repair wiring
On FCES cmptr:
• Chk air data inputs FIM
Yes
Chk ckt #2
Ckt # 2 chk ok
• Replace ADC-1 (-2) (34-14-01).
• If problem persists, replace pitch cmptr-1 (-2) (22-11-01)
A/C wiring fault
Repair wiring
Blk
On FCES cmptr:
• Chk yaw rate gyro-1 (-2) FIM
Yes
Replace yaw rate gyro-1 (-2) (22-15-02)
Blk
Chk ckt #3
Ckt No. 3 chk ok
• Replace roll cmptr-1 (-2) (22-13-01).
• If problem persists, replace yaw cmptr-1 (-2) (22-15-01)
A/C wiring fault
Repair wiring
NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( )
M1-0102-22-651

FD Basic Mode Faults
Figure 105 (Sheet 7)

18 CONTINUED



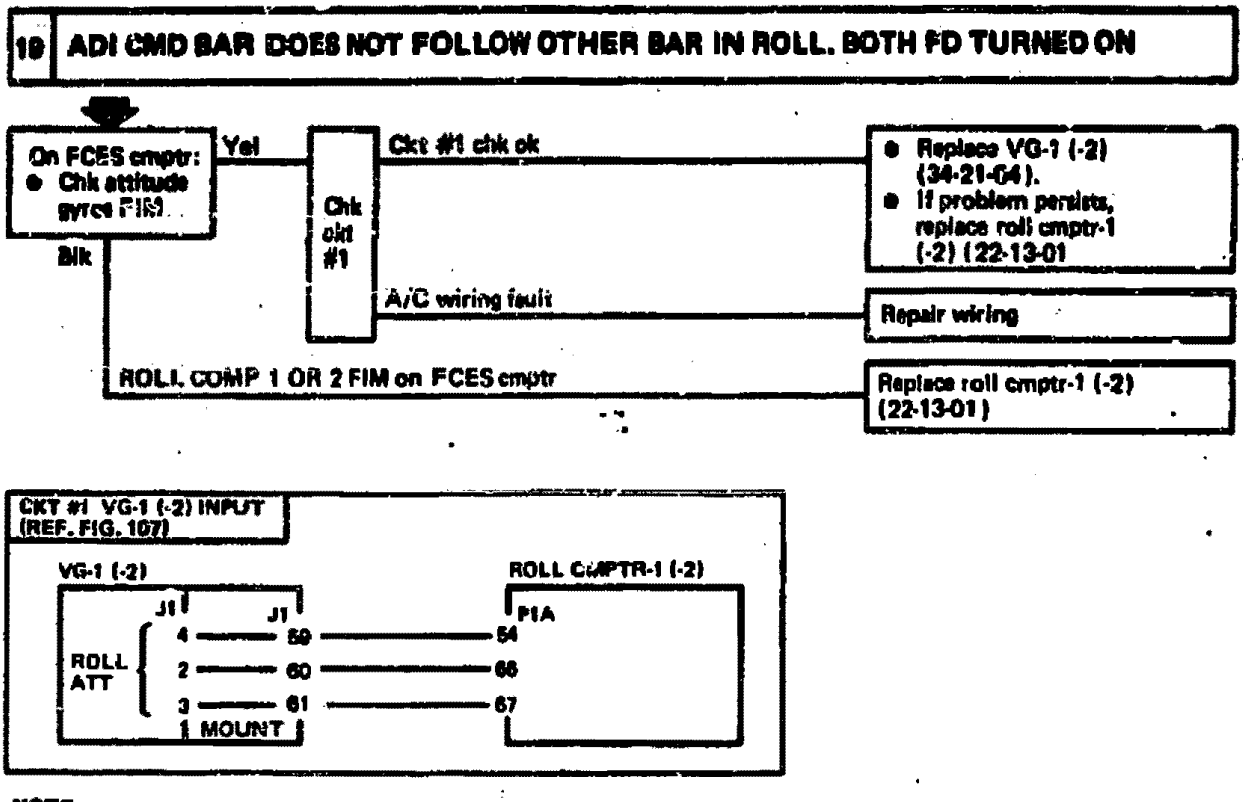
NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( )

M1-0002-22-862

FD Basic Modes Faults
Figure 105 (Sheet 8)

R EFFECTIVITY: ALL
R
001B

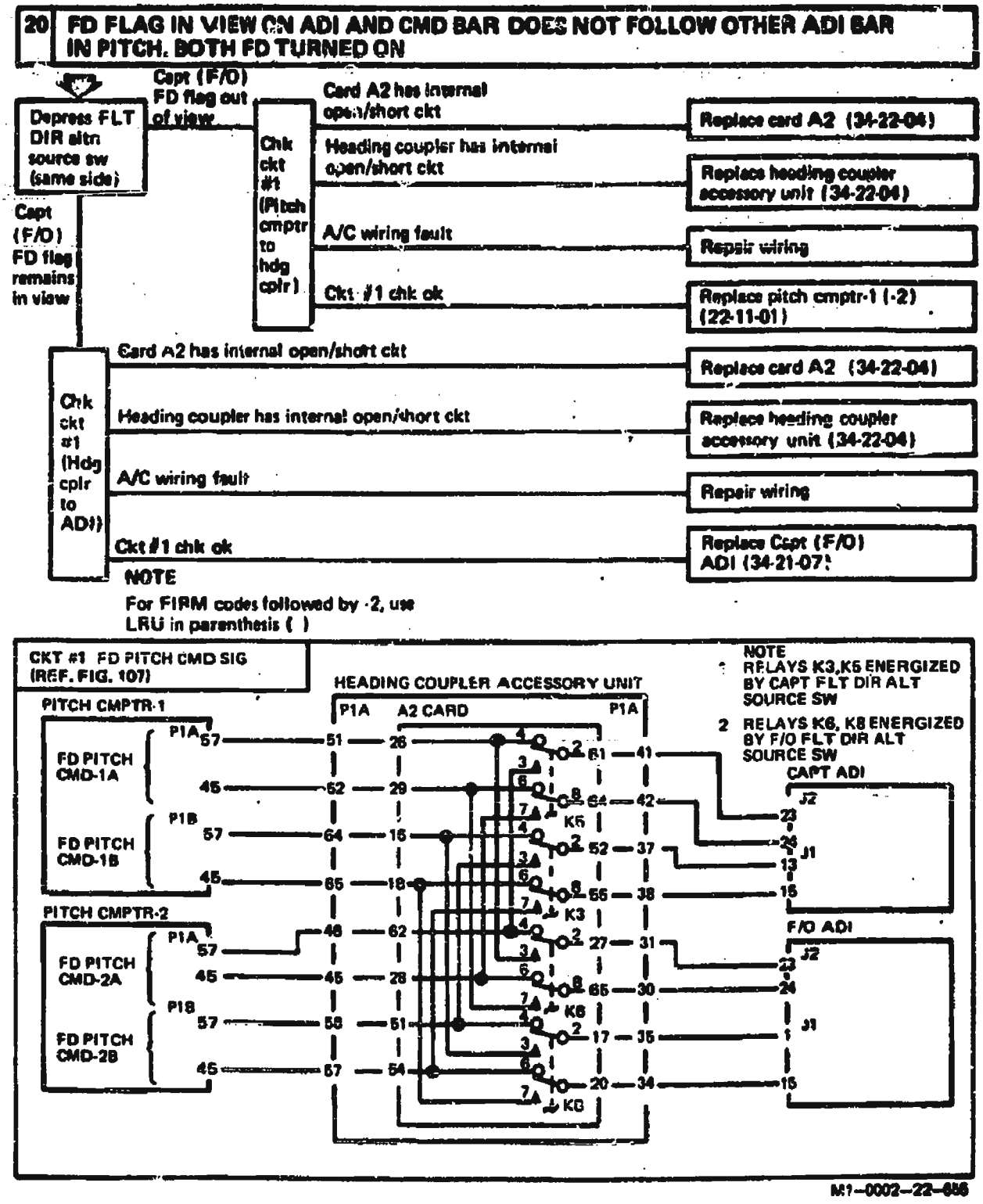


NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( )

M1-0001-22-683

FD Basic Mode Faults
Figure 105 (Sheet 9)


20 FD FLAG IN VIEW ON ADI AND CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN PITCH. BOTH FD TURNED ON
Depress FLT DIR altn source sw (same side)
Capt (F/O) FD flag out of view
Capt (F/O) FD flag remains in view
Chk ckt #1 (Pitch cmptr to hdg cplr)
Card A2 has internal open/short ckt
Heading coupler has internal open/short ckt
A/C wiring fault
Ckt #1 chk ok
Replace card A2 (34-22-04)
Replace heading coupler accessory unit (34-22-04)
Repair wiring
Replace pitch cmptr-1 (-2) (22-11-01)
Chk ckt #1 (Hdg cplr to ADI)
Card A2 has internal open/short ckt
Heading coupler has internal open/short ckt
A/C wiring fault
Ckt #1 chk ok
Replace card A2 (34-22-04)
Replace heading coupler accessory unit (34-22-04)
Repair wiring
Replace Capt (F/O) ADI (34-21-07)
NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( )
CKT #1 FD PITCH CMD SIG (REF. FIG. 107)
HEADING COUPLER ACCESSORY UNIT
P1A
A2 CARD
P1A
PITCH CMPTR-1
FD PITCH CMD-1A
FD PITCH CMD-1B
PITCH CMPTR-2
FD PITCH CMD-2A
FD PITCH CMD-2B
K5
K3
K6
K8
NOTE
1 RELAYS K3,K5 ENERGIZED BY CAPT FLT DIR ALT SOURCE SW
2 RELAYS K6, K8 ENERGIZED BY F/O FLT DIR ALT SOURCE SW
CAPT ADI
F/O ADI
J2
J1
M1-0002-22-65B

FD Basic Mode Faults
Figure 105 (Sheet 10)

20 FD FLAG IN VIEW ON ADI AND CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN PITCH. BOTH FD TURNED ON

Depress FLT DIR sltn source sw (same side)

Capt (F/O) FD flag out of view

Capt (F/O) FD flag remains in view

Chk ckt #1 (Pitch cmptr to hdg cplr)

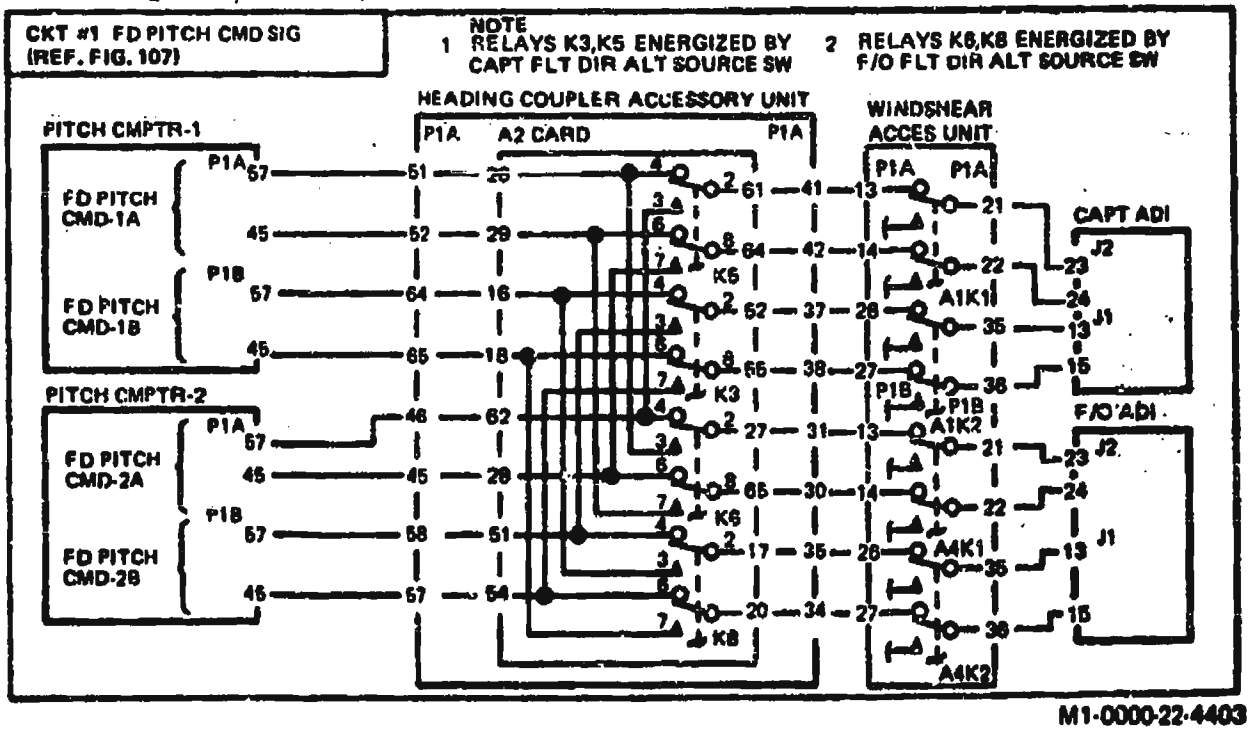
- Card A2 has internal open/short ckt → Replace card A2 (34-22-04)
- Heading coupler has internal open/short ckt → Replace heading coupler accessory unit (34-22-04)
- A/C wiring fault → Repair wiring
- Ckt #1 chk ok → Replace pitch cmptr-1 (-2) (22-11-01)

Chk ckt #1 (Hdg cplr to ADI)

- Card A2 has internal open/short ckt → Replace card A2 (34-22-04)
- Heading coupler has internal open/short ckt → Replace heading coupler accessory unit (34-22-04)
- A/C wiring fault → Repair wiring
- Ckt #1 chk ok → Replace Capt (F/O) ADI (34-21-07)

NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( )



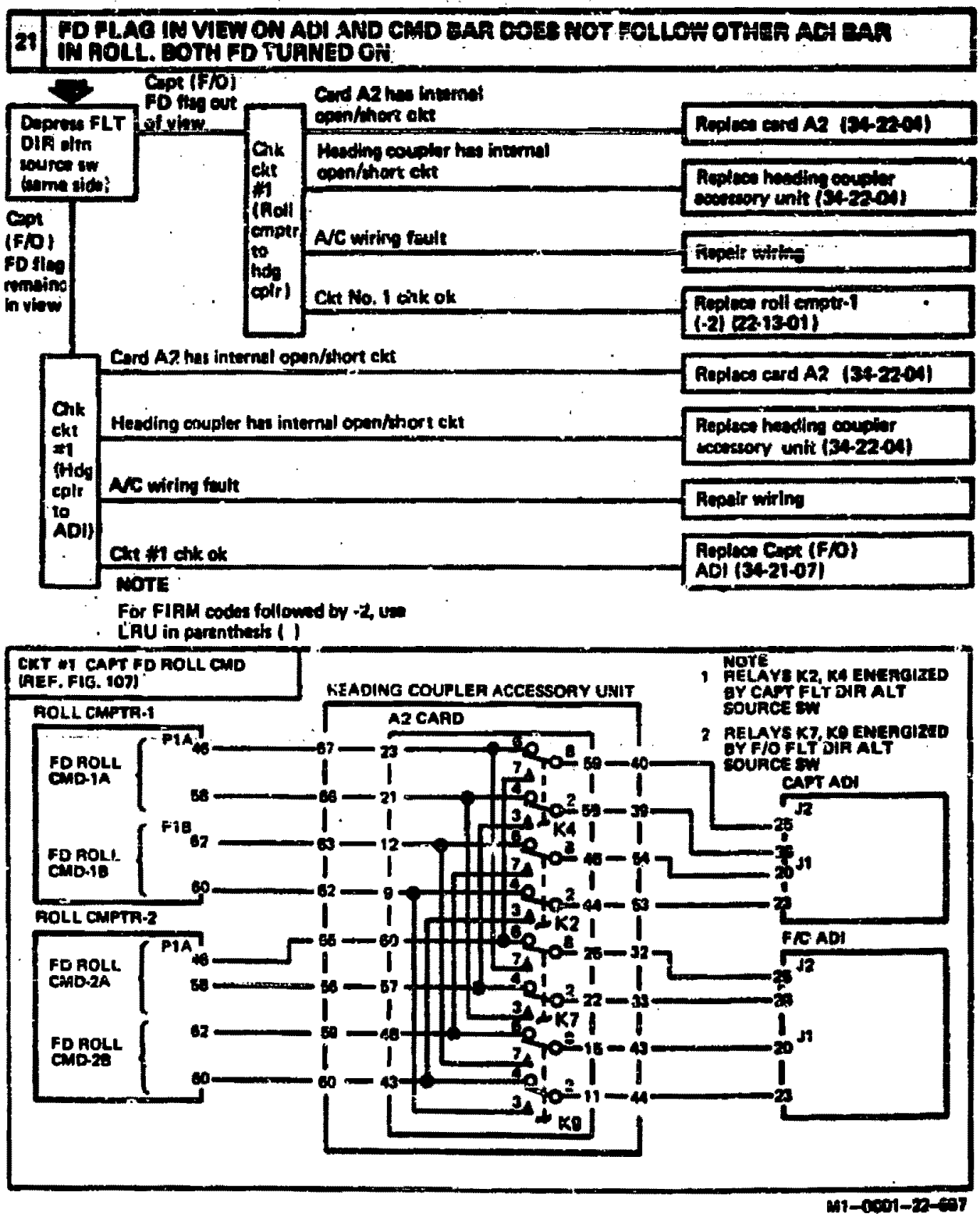
M1-0000-22-4403

R FD Basic Mode Faults
R Figure 105 (Sheet 10)

R EFFECTIVITY: AIRCRAFT WITH SB34-178

R

001B


21 FD FLAG IN VIEW ON ADI AND CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN ROLL. BOTH FD TURNED ON
Depress FLT DIR sltn source sw (same side)
Capt (F/O) FD flag out of view
Capt (F/O) FD flag remains in view
Chk ckt #1 (Roll cmptr to hdg cplr)
Chk ckt #1 (Hdg cplr to ADI)
Card A2 has internal open/short ckt
Heading coupler has internal open/short ckt
A/C wiring fault
Ckt No. 1 chk ok
Replace card A2 (34-22-04)
Replace heading coupler accessory unit (34-22-04)
Repair wiring
Replace roll cmptr-1 (-2) (22-13-01)
Card A2 has internal open/short ckt
Heading coupler has internal open/short ckt
A/C wiring fault
Ckt #1 chk ok
Replace card A2 (34-22-04)
Replace heading coupler accessory unit (34-22-04)
Repair wiring
Replace Capt (F/O) ADI (34-21-07)
NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( )
CKT #1 CAPT FD ROLL CMD (REF. FIG. 107)
HEADING COUPLER ACCESSORY UNIT
A2 CARD
ROLL CMPTR-1
FD ROLL CMD-1A
FD ROLL CMD-1B
ROLL CMPTR-2
FD ROLL CMD-2A
FD ROLL CMD-2B
P1A
P1B
K4
K2
K7
K9
NOTE
1 RELAYS K2, K4 ENERGIZED BY CAPT FLT DIR ALT SOURCE SW
2 RELAYS K7, K9 ENERGIZED BY F/O FLT DIR ALT SOURCE SW
CAPT ADI
F/O ADI
J1
J2
M1-0001-22-697

R FD Basic Mode Faults
R Figure 105 (Sheet 11)

EFFECTIVITY: AIRCRAFT WITHOUT SB34-178

21 FD FLAG IN VIEW ON ADI AND CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN ROLL. BOTH FD TURNED ON

Depress FLT DIR altn source sw (same side)

Capt (F/O) FD flag out of view

Chk ckt #1 (Roll cmptr to hdg cplr)

- Card A2 has internal open/short ckt → Replace card A2 (34-22-04)
- Heading coupler has internal open/short ckt → Replace heading coupler accessory unit (34-22-04)
- A/C wiring fault → Repair wiring
- Ckt No. 1 chk ok → Replace roll cmptr-1 (-2) (22-13-01)

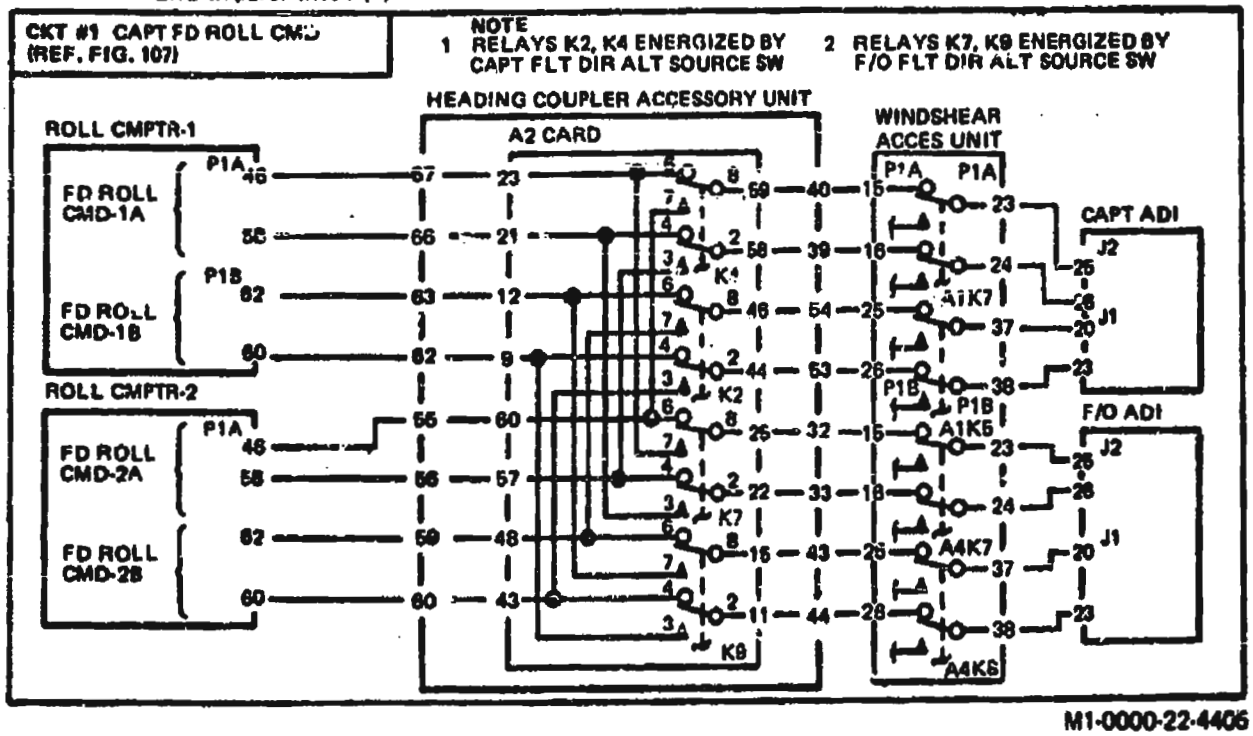
Capt (F/O) FD flag remains in view

Chk ckt #1 (Hdg cplr to ADI)

- Card A2 has internal open/short ckt → Replace card A2 (34-22-04)
- Heading coupler has internal open/short ckt → Replace heading coupler accessory unit (34-22-04)
- A/C wiring fault → Repair wiring
- Ckt #1 chk ok → Replace Capt (F/O) ADI (34-21-07)

NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( )



M1-0000-22-4406

R FD Basic Mode Faults
R Figure 105 (Sheet 11)

R EFFECTIVITY: AIRCRAFT WITH SB34-178

22 FD FLAG JITTERS IN AND OUT OF VIEW ON ADI

- Replace Capt (F/O) ADI (34-21-07)

NOTE: For FIRM codes followed by -2 use LRU in parenthesis ( ).

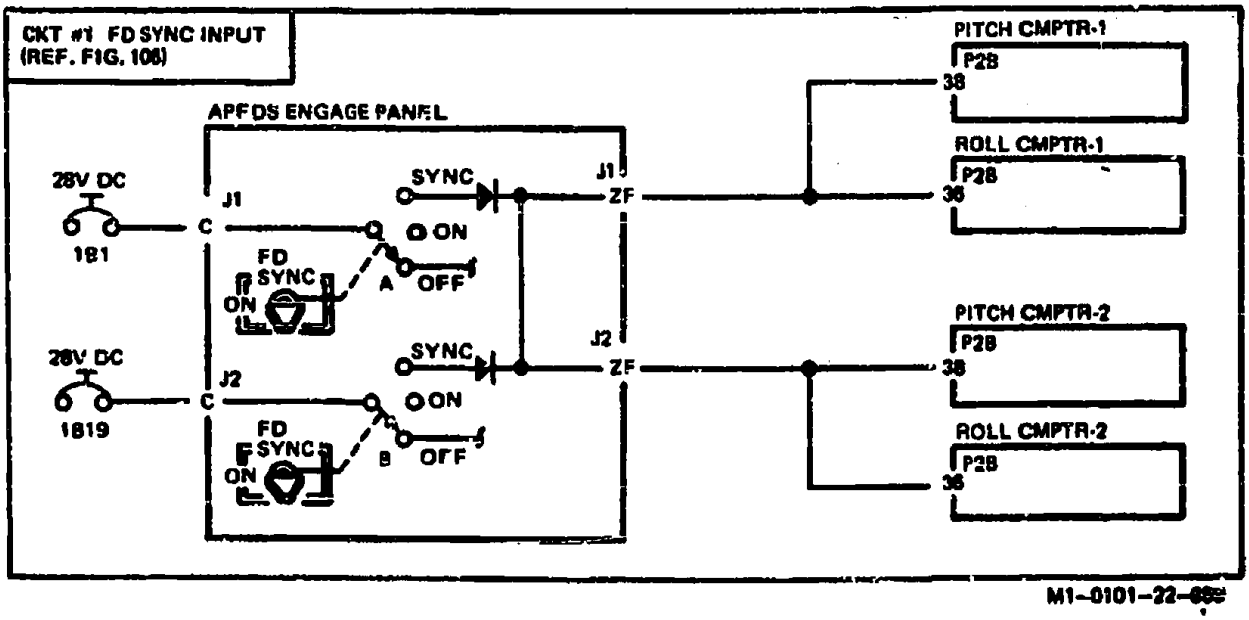
23 CMD BAR WILL NOT SYNC TO NEW ATTITUDE ON ADI WITH ONE FD SW

- Replace APFDS engage panel (22-10-01)

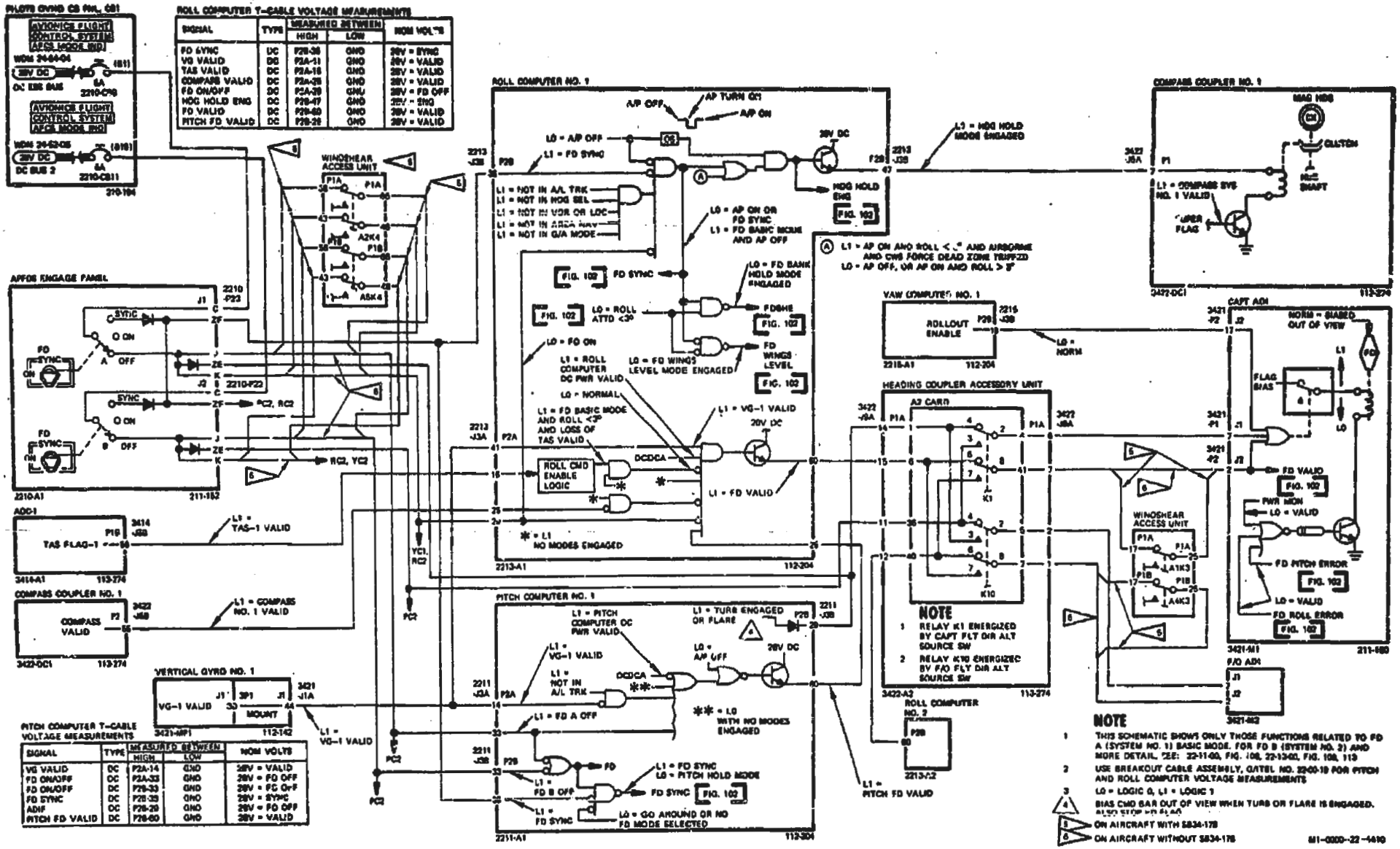
24 CMD BAR WILL NOT SYNC TO NEW ATTITUDE ON ADI WITH EITHER FD SW

Chk ckt #1

- Ckt #1 chk ok
  - Replace pitch cmptr-1 (-2) (22-11-01)
  - If problem persists, replace roll cmptr-1 (-2) (22-13-01)
- APFDS engage pnl has internal open ckt
  - Replace APFDS engage panel (22-10-01)
- A/C wiring fault
  - Repair wiring

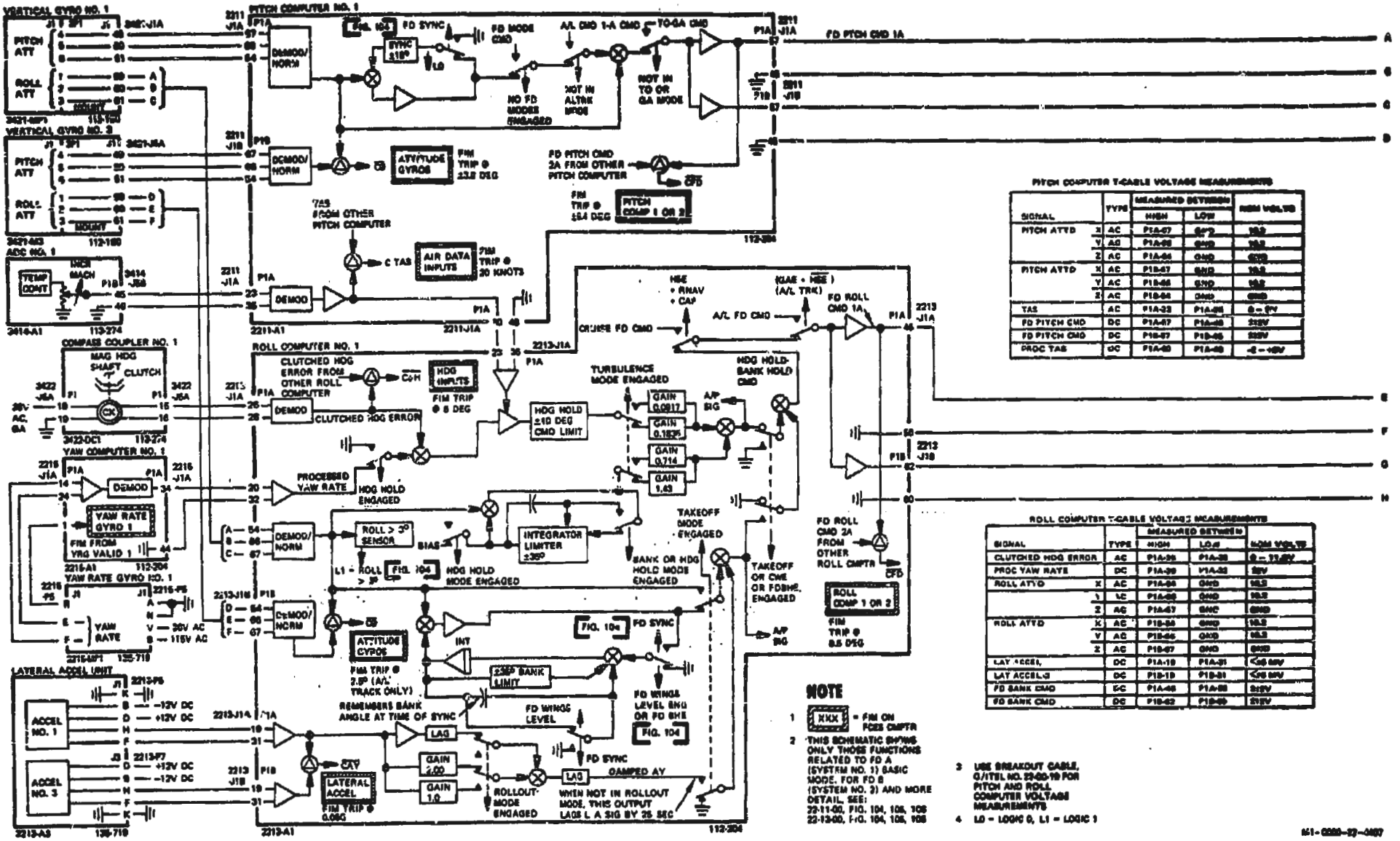


FD Basic Mode Faults
Figure 105 (Sheet 12)


ROLL COMPUTER T-CABLE VOLTAGE MEASUREMENTS
PITCH COMPUTER T-CABLE VOLTAGE MEASUREMENTS
ROLL COMPUTER NO. 1
PITCH COMPUTER NO. 1
COMPASS COUPLER NO. 1
CAPT ADI
F/O ADI
HEADING COUPLER ACCESSORY UNIT
YAW COMPUTER NO. 1
APFDS ENGAGE PANEL
WINDSHEAR ACCESS UNIT
VERTICAL GYRO NO. 1
NOTE
1 THIS SCHEMATIC SHOWS ONLY THOSE FUNCTIONS RELATED TO FD A (SYSTEM NO. 1) BASIC MODE. FOR FD B (SYSTEM NO. 2) AND MORE DETAIL, SEE: 22-11-00, FIG. 108, 22-13-00, FIG. 108, 113
2 USE BREAKOUT CABLE ASSEMBLY, GATEL NO. 2200-10 FOR PITCH AND ROLL COMPUTER VOLTAGE MEASUREMENTS
3 L0 = LOGIC 0, L1 = LOGIC 1
4 BIAS CMD BAR OUT OF VIEW WHEN TURB OR FLARE IS ENGAGED.
5 ON AIRCRAFT WITH SB34-178
6 ON AIRCRAFT WITHOUT SB34-178

FD Basic Mode Logic
Figure 106

EFFECTIVITY: ALL



PITCH COMPUTER T-CABLE VOLTAGE MEASUREMENTS

SIGNAL		TYPE	MEASURED BETWEEN HIGH	MEASURED BETWEEN LOW	NOM VOLTS
PITCH ATTD	X	AC	P1A-67	GND	10.0
	Y	AC	P1A-66	GND	10.0
	Z	AC	P1A-64	GND	GND
PITCH ATTD	X	AC	P1B-67	GND	10.0
	Y	AC	P1B-66	GND	10.0
	Z	AC	P1B-64	GND	GND
TAS		AC	P1A-23	P1A-35	0 – 5V
FD PITCH CMD		DC	P1A-67	P1A-45	±15V
FD PITCH CMD		DC	P1B-67	P1B-45	±15V
PROC TAS		DC	P1A-60	P1A-46	-2 – +10V

ROLL COMPUTER T-CABLE VOLTAGE MEASUREMENTS

SIGNAL		TYPE	MEASURED BETWEEN HIGH	MEASURED BETWEEN LOW	NOM VOLTS
CLUTCHED HDG ERROR		AC	P1A-26	P1A-25	0 – 11.8V
PROC YAW RATE		DC	P1A-29	P1A-46	±5V
ROLL ATTD	X	AC	P1A-64	GND	10.0
	Y	LC	P1A-66	GND	10.0
	Z	AC	P1A-67	GND	GND
ROLL ATTD	X	AC	P1B-64	GND	10.0
	Y	AC	P1B-66	GND	10.0
	Z	AC	P1B-67	GND	GND
LAT ACCEL		DC	P1A-19	P1A-31	<±0.06V
LAT ACCEL 3		DC	P1B-19	P1B-31	<±0.06V
FD BANK CMD		DC	P1A-46	P1A-60	±15V
FD BANK CMD		DC	P1B-62	P1B-60	±15V

NOTE

1 XXX = FIM ON PCES CMPTR

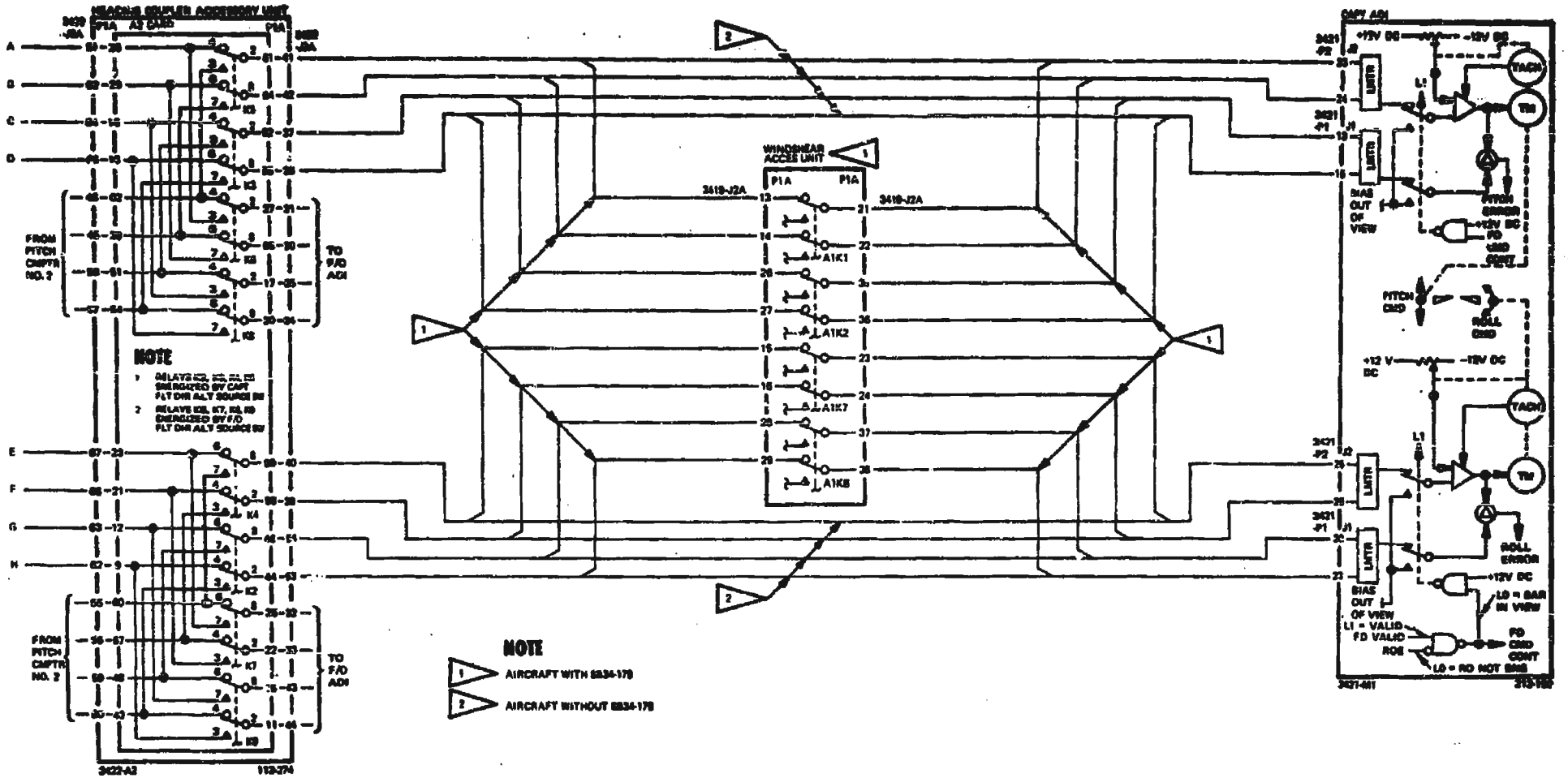
2 THIS SCHEMATIC SHOWS ONLY THOSE FUNCTIONS RELATED TO FD A (SYSTEM NO. 1) BASIC MODE. FOR FD B (SYSTEM NO. 2) AND MORE DETAIL, SEE: 22-11-00, FIG. 104, 105, 106 22-13-00, FIG. 104, 105, 106

3 USE BREAKOUT CABLE, G/ITEL NO. 22-00-10 FOR PITCH AND ROLL COMPUTER VOLTAGE MEASUREMENTS

4 LO = LOGIC 0, L1 = LOGIC 1

R
R

FD Basic Mode Signal Flow
Figure 107 (Sheet 1)



R FD Basic Mode Signal Flow
R Figure 107 (Sheet 2)

EFFECTIVITY: ALL

001B

FD BASIC MODE - ADJUSTMENT AND TEST

1. General

The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for appropriate fault isolation.

2. Equipment and Materials

R Attitude/Heading System Test Set - G/TEL, 34-21-78

3. Referenced Procedures

22-12-00 APFDS Modes of Operation - Maintenance Practices

4. Fault Detection Test

A. Preliminary Procedures

(1) Turn on APFDS as described in 22-12-00, maintenance practices.

B. FD Basic Mode Test

(1) On Capt and F/O attitude directors (ADI), check FD flags and command bars.

RESULT:

FD flags and command bars are out of view.

(2) On APFDS ENGAGE panel, set FD A and B switches to ON.

RESULT:

Both ADI command bars come into view and are level.

Both ADI FD flags are out of view.

NOTE: Wind conditions may cause VERT SPEED tape motion.

(3) On HEADING/PITCH MODE panel, VERT SPEED indicator reads approximately zero FPM. Depress VS switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, VS messages are
R displayed.

R On both ADIs, FD flags are out of view, and
R command bars are centered and level.

R (4) On HEADING/PITCH MODE panel, set VERT SPEED thumbwheel
R for a plus 1,000 ft per min (blue background)
R indication.

R RESULT:

R On both ADIs, command bars move up.

R (5) Depress VS switchlight to off.

R RESULT:

R VS messages are removed.

R (6) On HEADING/PITCH MODE panel, depress HDG switchlight to
R on.

R RESULT:

R On both AFCS MODES indicators, HDG SEL messages
R are displayed.

R On both ADIs, FD flags are out of view, and
R command bars are centered and level.

R (7) On CB1, open CMPS COUPLER (G7) and (G26) circuit
R breakers.

R RESULT:

R On both ADIs, FD flags are in view, and command
R bars are biased out of view.

R (8) Close G7 and G26 circuit breakers.

R (9) On HEADING/PITCH MODE panel, rotate HEADING knob to a
R heading approximately 10 degrees more than aircraft
R heading and then back to aircraft heading.

R RESULT:

R On both ADIs, command bars command right roll when
R heading knob is rotated 10 degrees more than
R aircraft heading.

(10) Depress HDG switchlight to off.

RESULT:

HDG SEL messages are removed.

(11) On pilots overhead COMPASS panels, manually slew both compass systems to a heading approximately 10 degrees more than aircraft heading.

RESULT:

On both ADIs, command bars command right roll as both compasses automatically slew back to aircraft heading at a rate of approximately 1.5 degrees per minute.

(12) On pilots overhead COMPASS panels, slew both compass systems to aircraft heading.

(13) On galley ceiling, zone 135, carefully remove yaw rate gyro 1 with cable still connected.

(14) Rotate gyro approximately 180 degrees clockwise (nose right) in approximately 2 seconds. On Capt ADI, command bar temporarily commands left roll.

(15) Reinstall yaw rate gyro 1, and remove yaw rate gyro 2 with cable still connected.

(16) Rotate gyro approximately 180 degrees clockwise (nose right) in approximately 2 seconds. On F/O ADI, CMD bar temporarily commands left roll.

(17) Reinstall yaw rate gyro No. 2.

R R NOTE: Steps (18) through (34) apply to aircraft with vertical gyros installed.

R R R NOTE: When inertial navigation units are installed, go to Steps (35) through (51) following test with vertical gyros.

(18) On CB1, open INSTR CMPRN MON PWR (D8) and (D26) circuit breakers.

NOTE: In the following procedures, use the ADI artificial horizon for determining vertical gyro position.

(19) In FESC forward rack, carefully lift vertical gyro No. 1 out of mount.

NOTE: Ensure that electrical power has been applied to aircraft, and G6, G24 and E24 circuit breakers on CB1 are closed for a minimum of 3 minutes before performing step (20).

R (20) Place vertical gyro No. 1 in approximately 10 degree nose-up attitude.

RESULT:

On Capt ADI, command bar commands nose down.

(21) On APFDS ENGAGE panel, momentarily set FD A switch to SYNC.

RESULT:

On Capt ADI, command bar centers.

(22) Carefully position vertical gyro No. 1 to level attitude.

(23) Set FD A and B switches to OFF, then ON.

(24) Carefully position vertical gyro No. 1 to approximately 10 degrees right-roll attitude.

RESULT:

On Capt ADI, command bar commands left roll.

(25) Hold FD A switch to SYNC.

RESULT:

On Capt ADI, command bar centers. Release FD A switch.

(26) Carefully position vertical gyro No. 1 in mount.

(27) In FCES forward rack, carefully lift vertical gyro No. 2 out of rack and place in approximately 10 degree nose-up attitude.

RESULT:

On F/O ADI, command bar commands nose down.

(28) Momentarily set FD B switch to SYNC.

RESULT:

On F.O ADI, command bar levels.

(29) Carefully position vertical gyro No. 2 to level attitude.

(30) Set FD A and B switches to OFF, then ON.

(31) Carefully position vertical gyro No. 2 to approximately 10 degrees right-roll attitude.

RESULT:

On F/O ADI, command bar commands left roll.

(32) Hold FD B switch to SYNC.

RESULT:

On F/O ADI, command bar levels.

Release FD B switch.

(33) Carefully position vertical gyro No. 2 in mount.

(34) Set both FD switches to OFF, then ON.

NOTE: The following Steps (35) through (51) apply to aircraft with inertials installed.

(35) On CB1, open INSTR CMPRN MON PWR (D8) and (D26) circuit breakers.

NOTE: In the following procedures, use the ADI artificial horizon for determining attitude position.

(36) In FESC forward rack, carefully lift inertial units from racks and install Attitude System Test Set; refer to 34-21-00,201 - Steps 4 and 5.

NOTE: Ensure that electrical power has been applied to aircraft, and inertial circuit breakers on CB1 are closed for a minimum of 3 minutes before performing Step (37).

(37) On Test Set, position SYS No. 1 PITCH synchro to approximately 10 degrees nose-up attitude.

RESULT:

On Capt ADI, command bar commands nose down.

(38) On APFDS ENGAGE panel, momentarily set FD A switch to SYNC.

RESULT:

On Capt ADI, command bar centers.

(39) On Test Set, position SYS No. 1 PITCH synchro to 0°.

(40) Set FD A and B switches to OFF, then ON.

(41) On Test Set, position SYS No. 1 ROLL synchro to approximately 10 degrees right-roll attitude.

RESULT:

On Capt ADI, command bar commands left roll.

(42) Hold FD A switch to SYNC.

RESULT:

On Capt ADI, command bar centers. Release FD A switch.

(43) On Test Set, position SYS No. 2 PITCH synchro to approximately 10 degrees nose-up attitude.

RESULT:

On F/O ADI, command bar commands nose down.

(44) Momentarily set FD B switch to SYNC.

RESULT:

On F/O ADI, command bar levels.

(45) On Test Set, position SYS No. 2 PITCH synchro to 0°.

(46) Set FD A and B switches to OFF, then ON.

(47) On Test Set, position SYS No. 2 ROLL synchro to approximately 10 degrees right-roll attitude.

RESULT:

On F/O ADI, command bar commands left roll.

(48) Hold FD B switch to SYNC.

RESULT:

On F/O ADI, command bar levels. Release FD B switch.

(49) Remove Attitude Test Set (Ref. 34-21-00,201).

(50) Carefully reinstall inertial units.

(51) Set both FD switches to OFF, then ON.

(52) On CB1, close INSTR CMPRN MON PWR (D8) and (D26) circuit breakers.

(53) On CB1, open VG/INS-1 (G6) circuit breaker.

RESULT:

On Capt ADI, FD and ATT flags are displayed and command bar is biased out of view.

(54) Close G6 circuit breaker.

(55) On CB1, open INS/VERT GYRO (G24) circuit breaker.

RESULT:

On F/O ADI, FD and ATT flags are displayed and command bar is biased out of view.

(56) Close G24 circuit breaker.

(57) Set both FD switches to OFF.

5. Fault Isolation

A. General

Table 501 is a summary of faults encountered when performing the Fault Detection Test. It also lists the fault number in Paragraph 4B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

FD Basic Mode Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
4B(1)-1	FD flag displayed on Capt ADI	(1)
4B(1)-2	Command bar in view on Capt ADI	(2)
4B(1)-3	FD flag displayed on F/O ADI	(3)
4B(1)-4	Command bar in view on F/O ADI	(4)
4B(2)-1	FD flag displayed on Capt ADI	(5)
4B(2)-2	Command bar not in view on Capt ADI	(6)
4B(2)-3	FD flag displayed on F/O ADI	(7)
4B(2)-4	Command bar not in view on F/O ADI	(8)
4B(2)-5	Command bar not level on Capt ADI	(9)
4B(2)-6	Command bar not centered on Capt ADI	(10)
4B(2)-7	Command bar not level on F/O ADI	(11)
4B(2)-8	Command bar not centered on F/O ADI	(12)
4B(3)	Vertical speed mode fault	(13)
4B(6) thru (9)	Heading select mode fault	(14)
4b(11)-1	Capt ADI command bar motion incorrect	(15)

FD Basic Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(11)-2	F/O ADI command bar motion incorrect	(16)
4B(14)	No Capt ADI left-roll command	(17)
4B(16)	No F/O ADI left-roll command	(18)
4B(20)	Capt ADI command bar motion incorrect	(19)
4B(21)	Capt ADI command bar not centered	(20)
4B(24)	Capt ADI command bar motion incorrect	(21)
4B(25)	Capt ADI command bar not level	(22)
4B(27)	F/O ADI command bar motion incorrect	(23)
4B(28)	F/O ADI command bar not centered	(24)
4B(31)	F/O ADI command bar motion incorrect	(25)
4B(32)	F/O ADI command bar not leveled	(26)
4B(36)	No Capt ADI fault indication	(27)
4B(38)	No F/O ADI fault indication	(28)

Schematics for Fault Isolation of FD Basic Mode Problem
Table 502

TITLE	LOCATION
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
FD Engage Logic Schematic	22-11-00, Schem 8
Turbulence, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic Schematic	22-11-00, Schem 13

Schematics for Fault Isolation of FD Basic Mode Problem (Cont)
Table 502

TITLE	LOCATION
Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic	22-13-00, Schem 4
Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic	22-13-00, Schem 5
HDG SEL, HDG HOLD, Capture, A/L TRK-S and R-NAV Mode Engage Logic Schematic	22-13-00, Schem 8
Roll Command Enable and FD Valid Logic Schematic	22-13-00, Schem 13

B. FD Basic Mode Faults

(1) Fault: FD flag displayed on Capt ADI

(a) On Capt ADI, is command bar in view?

Yes: Replace Capt ADI (Ref. 34-21-07).

No: Go to Step (b).

(b) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On Capt ADI, is FD flag displayed?

Yes: Replace Capt ADI (Ref. 34-21-07). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

No: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(2) Fault: Command bar in view on Capt ADI

(a) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On Capt ADI, is command bar in view?

Yes: Replace Capt ADI (Ref. 34-21-07).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, replace roll computer No. 1 (Ref. 22-13-01).

---

(3) Fault: FD flag displayed on F/O ADI

(a) On F/O ADI, is command bar in view?

Yes: Replace F/O ADI (Ref. 34-21-07).

No: Go to Step (b).

(b) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, is FD flag displayed?

Yes: Replace F/O ADI (Ref. 34-21-07). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

No: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(4) Fault: Command bar in view on F/O ADI

(a) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, is command bar in view?

Yes: Replace F/O ADI (Ref. 34-21-07).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, replace roll computer No. 2 (Ref. 22-13-01).

---

(5) Fault: FD flag displayed on Capt ADI

(a) On Capt ADI, does FD flag jitter in and out of view?

Yes: Replace Capt ADI (Ref. 34-21-07).

No: Go to Step (b).

(b) On Capt ADI, is ATT flag displayed?

Yes: Check VG/IU No. 1 for fault (Ref. 34-21-00/34-43-00).

R No: Go to Step (c).

(c) On Capt HSI, is HDG flag displayed?

Yes: Check compass system No. 1 for fault (Ref. 34-22-00).

No: Go to Step (d).

(d) On Capt MACH/AIRSPEED indicator, is AS flag displayed?

Yes: Check air data system No. 1 for fault (Ref. 34-14-00).

No: Go to Step (e).

(e) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On Capt ADI, is FD flag displayed?

Yes: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace Capt ADI (Ref. 34-21-07).

R No: Go to Step (f).

(f) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, is FD flag displayed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace pitch computer No. 1 (Ref. 22-11-01), then heading coupler accessory unit (34-22-06).

No: Replace heading coupler accessory unit (Ref. 34-22-06).

---

(6) Fault: Command bar not in view on Capt ADI

(a) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On Capt ADI, is command bar in view?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace pitch computer No. 1 (Ref. 22-11-01), then yaw computer No. 1 (Ref. 22-15-01).

No: Replace Capt ADI (Ref. 34-21-07).

---

(7) Fault: FD flag displayed on F/O ADI

(a) On F/O ADI, does FD flag jitter in and out of view?

Yes: Replace F/O ADI (Ref. 34-21-07).

No: Go to Step (b).

(b) On F/O ADI, is ATT flag displayed?

Yes: Check VG/IU No. 2 for fault (Ref. 34-21-00/34-43-00).

No: Go to Step (c).

(c) On F/O HSI, is HDG flag displayed?

Yes: Check compass system No. 2 for fault (Ref. 34-22-00).

No: Go to Step (d).

(d) On F/O MACH/AIRSPEED indicator is AS flag displayed?

Yes: Check air data system No. 2 for fault (Ref. 34-14-00).

No: Go to Step (e).

(e) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, is FD flag displayed?

Yes: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace F/O ADI (Ref. 34-21-07).

No: Go to Step (f).

(f) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On Capt ADI, is FD flag displayed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace pitch computer No. 2 (Ref. 22-11-01), then heading coupler accessory unit (Ref. 34-22-06).

No: Replace heading coupler accessory unit (Ref. 34-22-06).

---

(8) Fault: Command bar not in view on F/O ADI

(a) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, is command bar in view?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace pitch computer No. 2

(Ref. 22-11-01), then yaw computer No. 2 (Ref. 22-15-01).

No: Replace F/O ADI (Ref. 34-21-07).

---

(9) Fault: Command bar not level on Capt ADI

(a) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On Capt ADI, is command bar level?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace yaw computer No. 1 (Ref. 22-15-01), replace yaw rate gyro No. 1 (Ref. 22-15-02), check VG/IU No. 1 (Ref. 34-21-00/34-43-00) for fault in that order.

No: Replace Capt ADI (Ref. 34-21-07).

---

(10) Fault: Command bar not centered on Capt ADI

(a) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On Capt ADI, is command bar centered?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problems persists, check VG/IU No. 1 for fault (Ref. 34-21-00/34-43-00).

No: Replace Capt ADI (Ref. 34-21-07).

---

(11) Fault: Command bar not level on F/O ADI

(a) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, is command bar level?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace yaw computer No. 2 (Ref. 22-15-01), replace yaw rate gyro No. 2 (Ref 22-15-02), and check VG/IU No. 2 (Ref. 34-21-00/34-43-00) for fault in that order.

No: Replace F/O ADI (Ref. 34-21-07).

(12) Fault: Command bar not centered on F/O ADI

(a) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, is command bar centered?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check VG/IU No. 2 (Ref. 34-21-00/34-43-00) for fault.

R

No: Replace F/O ADI (Ref. 34-21-07).

(13) Fault: Vertical speed mode fault

(a) See vertical speed mode fault isolation procedure (Ref. 22-12-11).

(14) Fault: Heading select mode fault

(a) See heading select mode fault isolation procedure (Ref. 22-12-15).

(15) Fault: Capt ADI command bar motion incorrect

(a) Does compass system No. 1 automatically slew towards existing aircraft magnetic heading at approximately 1.5 degrees per minute?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, check compass system No. 1 for fault (Ref. 34-22-00).

No: Check compass system No. 1 for fault (Ref. 34-22-00).

(16) Fault: F/O ADI command bar motion incorrect

(a) Does compass system No. 2 automatically slew towards existing aircraft magnetic heading at approximately 1.5 degrees per minute?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, check compass system No. 2 for fault (Ref. 34-22-00).

No: Check compass system No. 2 for fault (Ref. 34-22-00).

---

(17) Fault: No Capt ADI left-roll command

(a) Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace yaw computer No. 1 (Ref. 22-15-01), then replace yaw rate gyro No. 1 (Ref. 22-15-02).

---

(18) Fault: No F/O ADI left-roll command

(a) Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace yaw computer No. 2 (Ref. 22-15-01), then replace yaw rate gyro No. 2 (Ref. 22-15-02).

---

(19) Fault: Capt ADI command bar motion incorrect

(a) On Capt ADI, is ATT flag displayed?

R Yes: Check VG/IU No. 1 for fault (Ref. 34-21-00/34-43-00)

No: Go to Step (b).

(b) Does Capt ADI show aircraft attitude?

Yes: Go to Step (c).

R No: Check VG/IU No. 1 (Ref. 34-21-00/34-43-00) for fault.

(c) Does command bar remain in view?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problems persists, check VG/IU No. 1 (Ref. 34-21-00/34-43-00) for fault.

R No: Go to Step (d).

(d) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. Does command bar remain out of view?

R Yes: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace Capt ADI (Ref. 34-21-07).

R No: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

---

(20) Fault: Capt ADI command bar not centered

(a) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend and note F/O ADI command bar position. On APFDS ENGAGE panel, momentarily set FD B switch to SYNC. On F/O ADI, does command bar move to center?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01).

No: Replace pitch computer No. 1 (Ref. 22-11-01).

---

(21) Fault: Capt ADI command bar motion incorrect

(a) On Capt ADI, is ATT flag displayed?

Yes: Check VG/IU No. 1 for fault (Ref. 34-21-00/34-43-00)

No: Go to Step (b).

(b) Does Capt ADI show aircraft attitude?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, check VG/IU No. 1 for fault (Ref. 34-21-00/34-43-00).

R No: Check VG/IU No. 1 for fault (Ref. 34-21-00/34-43-00).

---

(22) Fault: Capt ADI command bar not leveled

(a) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend, and

note F/O ADI command bar position. On APFDS ENGAGE panel, momentarily set FD B switch in SYNC. On F/O ADI, is command bar leveled?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01).

No: Replace roll computer No. 1 (Ref. 22-13-01).

---

(23) Fault: F/O ADI command bar motion incorrect

(a) On F/O ADI, is ATT flag displayed?

Yes: Check VG/IU No. 2 for fault (Ref. 34-21-00/34-43-00).

R No: Go to Step (b).

(b) Does F/O ADI show aircraft attitude?

Yes: Go to Step (c).

No: Check VG/IU No. 2 for fault (Ref. 34-21-00/34-43-00).

(c) Does command bar remain in view?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check VG/IU No. 2 for fault (Ref. 34-21-00/34-43-00).

R No: Go to Step (d).

(d) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. Does command bar on Capt ADI command nose-down?

Yes: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace F/O ADI (Ref. 34-21-07).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

---

(24) Fault: F/O ADI command bar not centered

(a) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend.

Note Capt ADI command bar position. On APFDS ENGAGE panel, momentarily set FD A switch to SYNC. Does command bar on Capt ADI move to center?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

---

(25) Fault: F/O ADI command bar motion incorrect

(a) On F/O ADI, is ATT flag displayed?

Yes: Check VG/IU No. 1 for fault (Ref. 34-21-00/34-43-00).

No: Go to Step (b).

(b) Does F/O ADI show aircraft attitude?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, check VG/IU No. 2 for fault
R (Ref. 34-21-00/34-43-00).

R No: Check VG/IU No. 2 for fault
R (34-21-00/34-43-00).

---

(26) Fault: F/O ADI command bar not leveled

(a) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. Note Capt ADI command bar position. On APFDS ENGAGE panel, momentarily set FD A Switch to SYNC. On Capt ADI, is command bar leveled?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01).

No: Replace roll computer No. 2 (Ref. 22-13-01).

---

(27) Fault: No Capt ADI fault indication

(a) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN. On F/O ADI, is FD flag displayed?

Yes: Replace Capt ADI (Ref. 34-21-07).

No: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace pitch computer No. 1 (Ref. 22-11-01).

---

(28) Fault: No F/O ADI fault indication

(a) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN. On Capt ADI, is FO flag displayed?

Yes: Replace F/O ADI (Ref. 34-21-07).

No: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace pitch computer No. 2 (Ref. 22-11-01).

AUTOPILOT CWS/CMD MODE - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting autopilot CWS/CMD mode faults are included in this section of the manual. An autopilot CWS/CMD mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code number. This number and the flight log book write-up can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use autopilot CWS/CMD mode fault matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring diagram manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the autopilot CWS/CMD mode fault isolation diagrams and schematics. Figures 101 and 102 provide component location for autopilot CWS/CMD mode troubleshooting.

A. General

Autopilot CWS/CMD mode fault isolation contains two levels of troubleshooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation trouble shoots a specific AP CWS or CMD mode problem. System oriented fault isolation (Ref. 22-10-33, Page 501) tests and trouble shoots autopilot A CWS/CMD mode problems. Autopilot B is located
R in section 22-10-35, Page 501.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the AP CWS/CMD mode by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-10-33, Page 501 for system
R A and 22-10-35, Page 501 for system B) to isolate problem.

R Figure 104 provides diagnostic steps to further isolate the
R fault. The diagnostic steps are in a flow chart form which
R contains complete fault isolation procedures for each fault.
R Action instructions are contained within the blocks of the
R flow chart while the monitored results of the actions are
R outside the blocks. When using the flow charts, it is
R assumed that systems are in the normal operational mode, all
R relevant circuit breakers have been checked, and all
R applicable aircraft operational procedures have been
R accomplished.

R Fault Isolation Diagrams and Schematic List
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Autopilot CWS/CMD Mode Fault Matrix
104	Autopilot Locked-Off Faults
105	Autopilot Engage Logic Simplified Schematic
106	Autopilot Will Not Remain Engaged Faults
107	Autopilot CWS Signal Flow Simplified Schematic
108	Autopilot "CWS" Cruise Mode Faults
109	Autopilot Porpoising Faults
110	Control Column Buzz with AP Turned-on Faults
22-11-00 SCHEM 4	Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode Signal Flow Schematic
22-11-00 SCHEM 9	CWS Mode Engage Logic Schematic
22-11-00 SCHEM 10	CMD Mode Engage Logic Schematic
22-11-00 SCHEM 11	Pitch Command Valid Logic Schematic
22-13-00 SCHEM 4	Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic

R R R Fault Isolation Diagrams and Schematic List (Cont)
Table 101

R R R FIGURE	TITLE
R 22-13-00 R SCHEM 10	Roll Servo Engage/Valid Logic Schematic
R 22-13-00 R SCHEM 11	A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic
R 22-13-00 R SCHEM 13	Roll Command Enable and FD Valid Logic Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCELEROMETER – NORMAL	1	GALY CLG/135DB	22-11-02
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – SPEED CONTROL	1	FESC, CTR RACK/112AB	22-31-07
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
COUPLER – COMPASS	2	FESC, REAR RACK/112AB	34-22-03
EHV – AP A (B) HYD SYS B (A) "PITCH"	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-08
EHV – AP A (B) HYD SYS B (A) "ROLL"	2	L WING, ON L INBD AIL SERVO/551BB	27-11-21
GYRO – DIRECTIONAL	2	FESC, GYRO RACK/112AB	34-22-04
GYRO – VERTICAL ATTITUDE REFERENCE	3	FESC, FWD RACK/112AB	34-21-04
GYRO – YAW RATE	3	GALY GALY CLG/135DB	22-15-02
INDICATOR – AFCS WARNING	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-06
PANEL – APFDS ENGAGE	1	FLT STA, GLRSHLD PNL	22-10-01
SERVO – STABILIZER AUTOPILOT CONTROL	1	AFTERBODY/316DB	22-11-05
SERVO CONTROL MODULE – LEFT INBOARD AILERON	1	L WING/551BB	27-11-17
SERVO MODULE – RUDDER	1	VERT STAB/324AL, 324AR	27-21-07
SWITCH – AP A (B) HYD SYS B (A) HIGH AUTHORITY HOOK PRESSURE	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-09
SWITCH – AP A (B) HYD SYS B (A) HOOK PRESSURE	2	L WING, ON L INBD AIL SERVO/551BB	27-11-37
SWITCH – AP A (B) HYD SYS B (A) LOW AUTHORITY HOOK PRESSURE	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-09

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R R Component Location Index
Figure 101 (Sheet 1)

R R 001B EFFECTIVITY: ALL

COMPONENT	QTY	AREA/ACCESS	REFERENCE
SWITCH – AP A (B) HYD SYS B (A) PRESSURE	2	VERT STAB; ON RUD SERVO MDL/324AL, 324AR	27-21-24
SWITCH – AUTOPILOT DISCONNECT	2	FLT STA, CONT WHL	22-10-21
SWITCH BOX – FLAP PDU	2	HSC, ON FLAP PDU/147AB	27-51-12
SWITCH MECHANISM – AILERON AUTHORITY LIMIT	2	HSC, AFT LEFT CLG/147AB	27-11-38
TRANSDUCER – LEFT INBOARD AILERON DUAL POSITION	2	L WING/551AB	22-13-03
TRANSDUCER – RUDDER DUAL POSITION	2	VERT STAB/324CL, 325DL	22-15-03
UNIT – INERTIAL NAVIGATION ——— 1	3	FESC, FWD RACK/112AB	34-43-03
VALVE – AP A (B) HYD SYS B (A) HIGH AUTHORITY HOOK ENGAGE SOLENOID	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-07
VALVE – AP A (B) HYD SYS B (A) LOW AUTHORITY HOOK ENGAGE SOLDENOID	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-07
VALVE – AP A (B) HYD SYS B (A) PRESSURE SHUTOFF	2	L WING, ON L INBD AIL SERVO/551BB	27-11-20
VALVE – AP A (B) HYD SYS B (A) PRESSURE SOLENOID	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-10-07
VALVE – HYD SYS B (A) SERVO PRESSURE SHUTOFF	2	L WING, ON L INBD AIL SERVO/551BB	27-11-20
WHEEL – CONTROL	2	FLT STA	27-11-00

EFFECTIVITY

1 INS EQUIPPED AIRCRAFT

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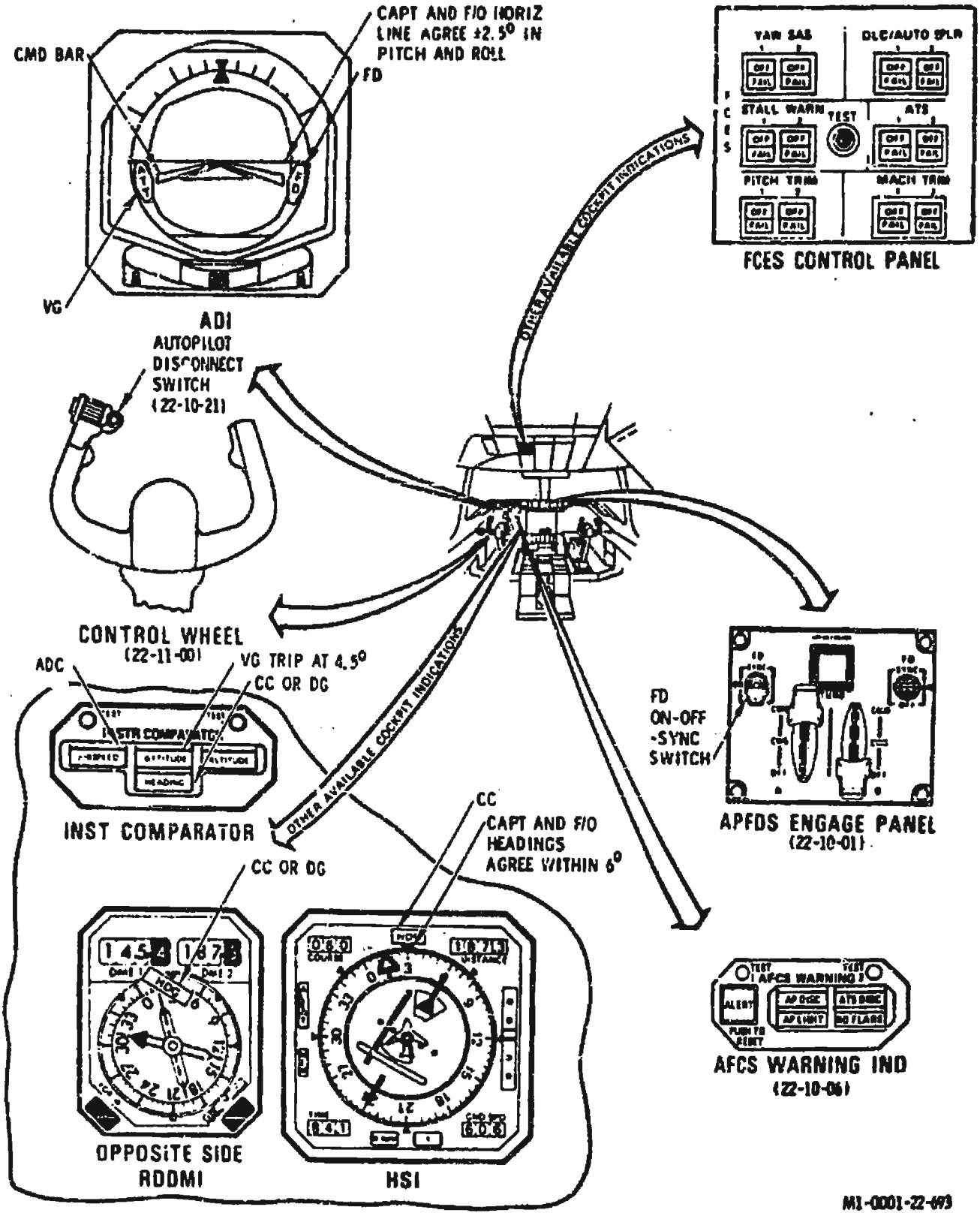
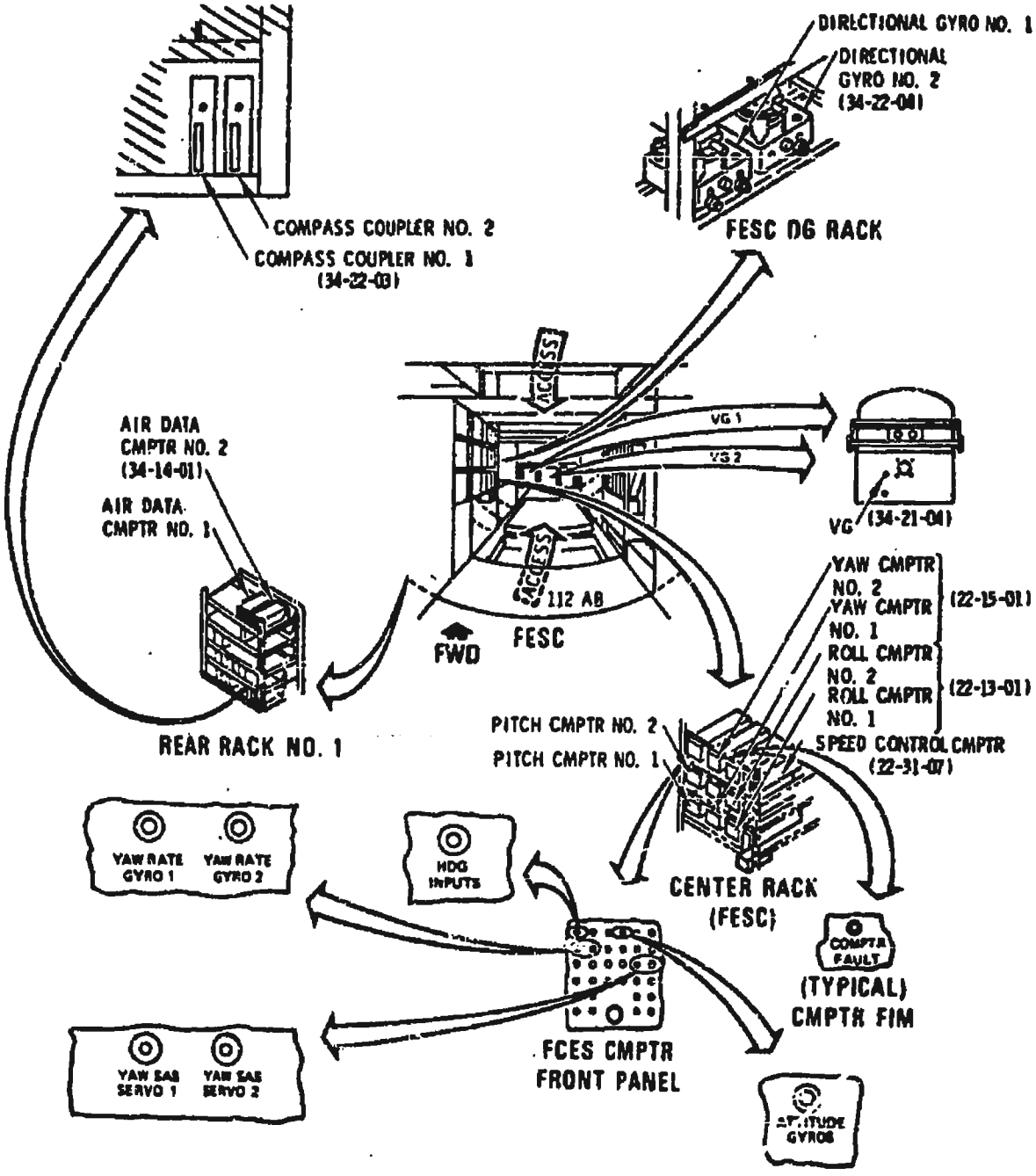
R R Component Location Index
Figure 101 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



Component Locator Diagram
Figure 102 (Sheet 1)

EFFECTIVITY: ALL



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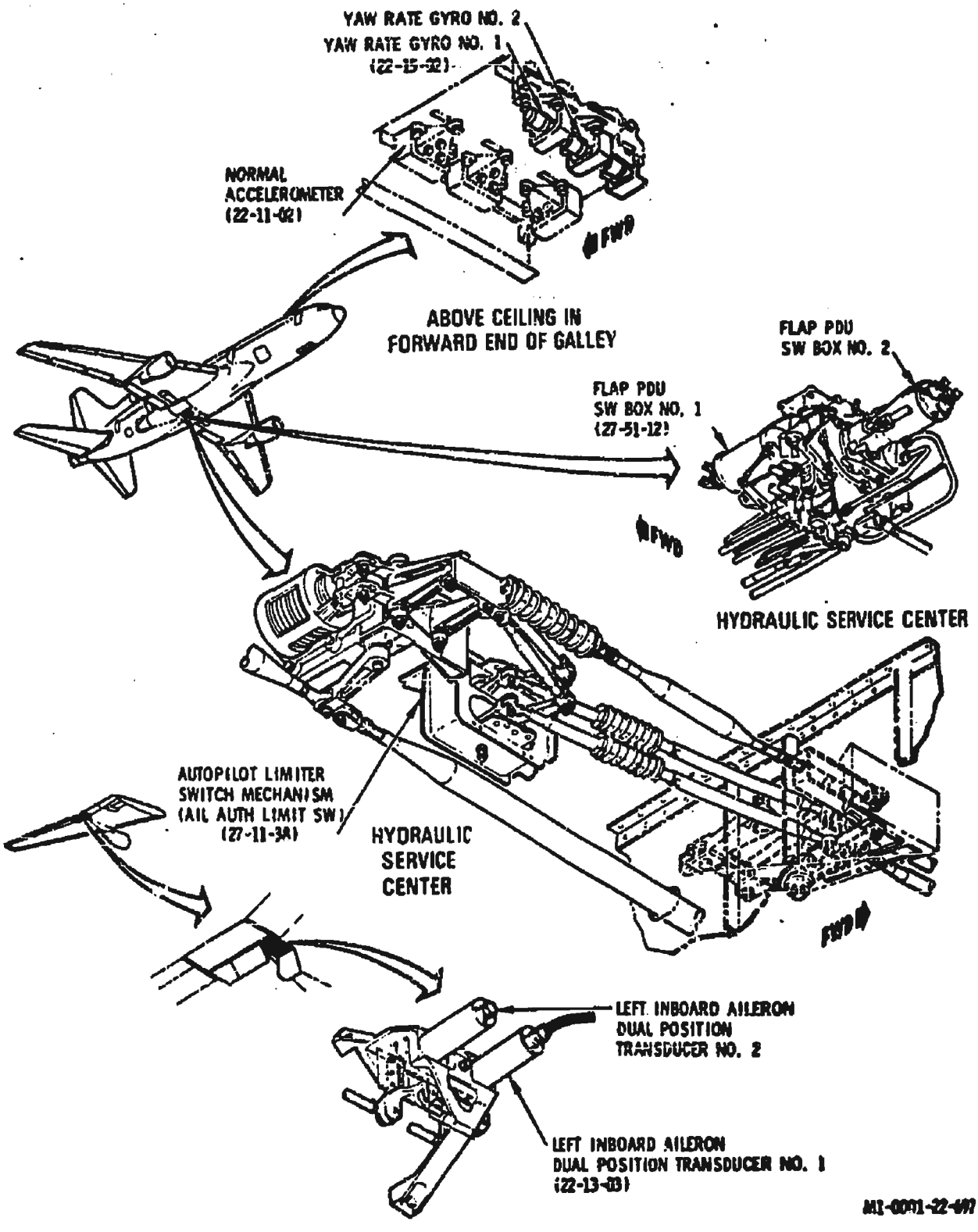
R Component Locator Diagram
R Figure 102 (Sheet 2)

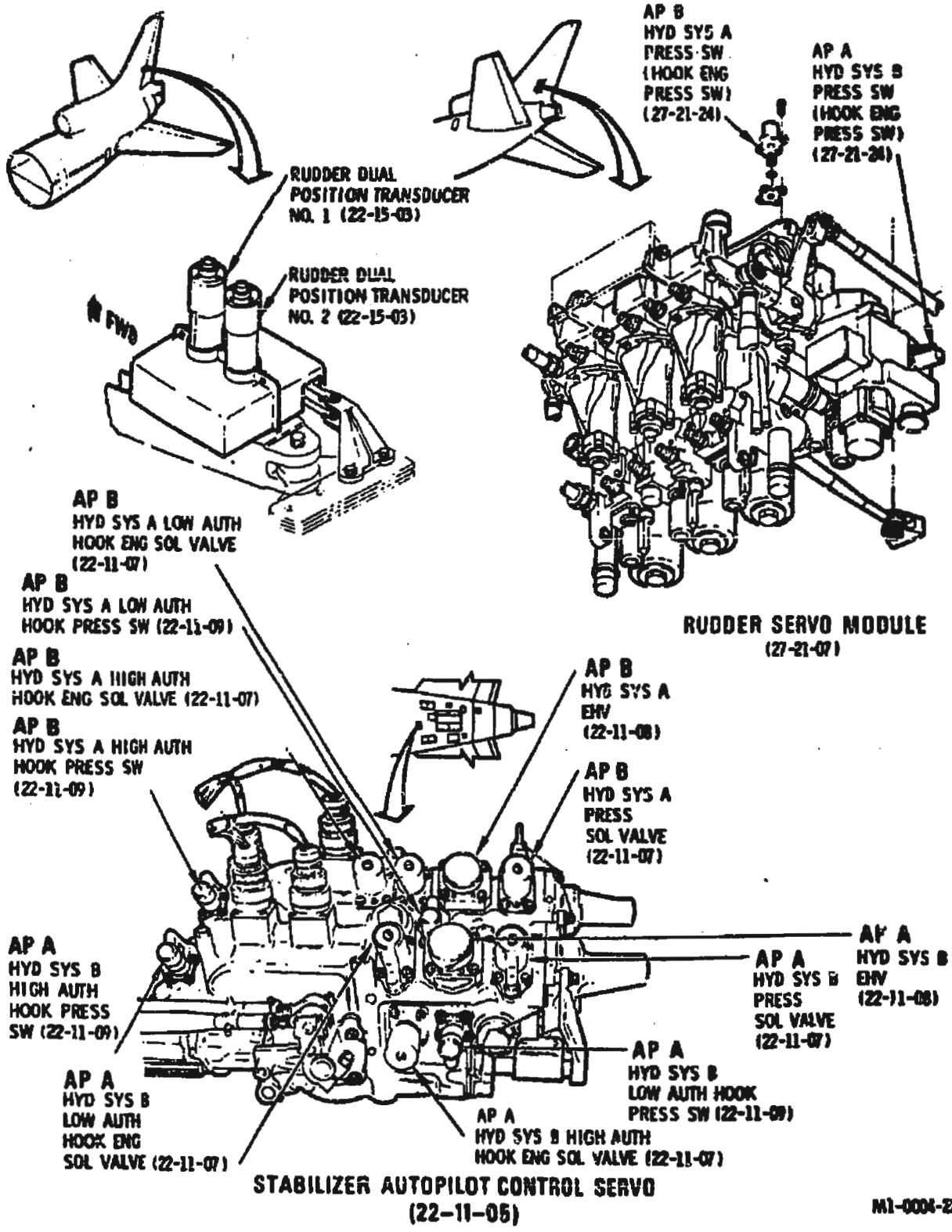
R EFFECTIVITY: ALL
R
001B



R R Component Locator Diagram
Figure 102 (Sheet 3)

R R EFFECTIVITY: ALL

001B



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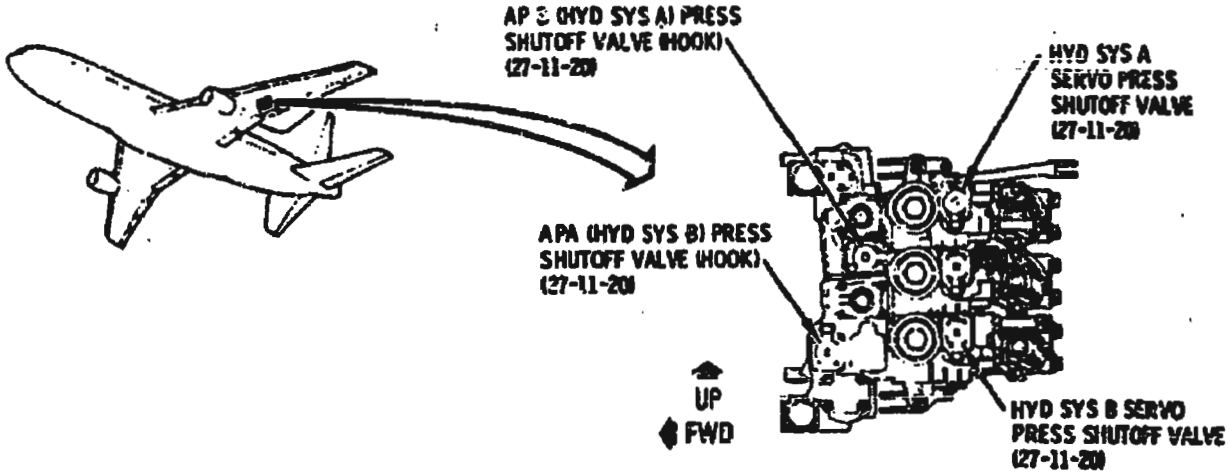
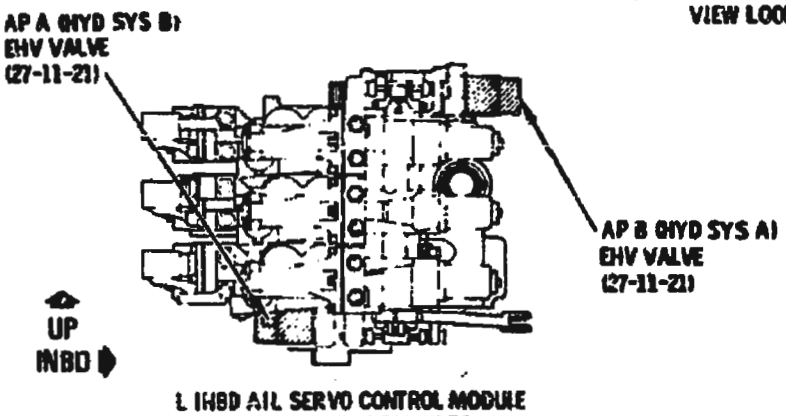
Component Locator Diagram
Figure 102 (Sheet 4)

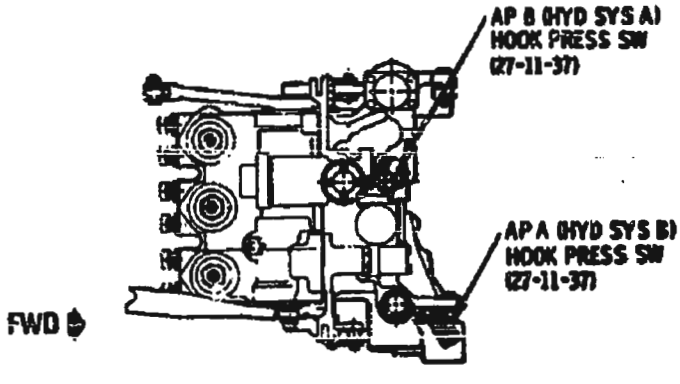
EFFECTIVITY: ALL


AP B (HYD SYS A) PRESS SHUTOFF VALVE (HOOK) (27-11-20)
HYD SYS A SERVO PRESS SHUTOFF VALVE (27-11-20)
APA (HYD SYS B) PRESS SHUTOFF VALVE (HOOK) (27-11-20)
UP
FWD
HYD SYS B SERVO PRESS SHUTOFF VALVE (27-11-20)

L INBD AIL SERVO CONTROL MODULE
VIEW LOOKING INBOARD



L INBD AIL SERVO CONTROL MODULE
VIEW LOOKING FORWARD



L INBD AIL SERVO CONTROL MODULE
VIEW LOOKING OUTBOARD

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Component Locator Diagram
Figure 102 (Sheet 5)

R
R
001B

EFFECTIVITY: ALL

FAULTS — FIM — NO FIM

No.	Problem (AP A or B)	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: PC	IRC	YC	SC	VG	CC	DG	NA	YRG	RUD SVO	Continuity Check or Replace: AIL AUTH LIMIT SW-1	AIL POSN XDCR	AP DISC SW	APFDS ENG PNL	AP PRESS SW	FLAP PDU SB	RUD POSN XDCR	CAPT OR F/O CONT WHL
	"AP LOCKED-OFF FAULTS" (Ref. Fig. 104)																		
1	AP A (B) bat handle locked-off. No other cockpit indications	1/2	1/2	1/2								X		X	X				
2	AP A (B) bat handle locked-off. ATT flag in-view on ADI (same side). FD flag in-view, CMD bar out-of-view on ADI (same side) when FD turned-on					1/2													
3	AP A (B) bat handle locked-off. HDG flag in-view on HSI (same side) and on RDDMI (opposite side). FD flag in-view, CMD bar out-of-view on ADI (same side) when FD turned on						1/2	1/2											
4	AP A (B) bat handle locked-off. FD flag in-view, CMD bar out-of-view on ADI (same side) when FD turned-on	1/2	1/2			1/2	1/2												
5	AP A (B) bat handle locked-off. ATS FAIL light (same side) comes on and ADI (same side) FAST/SLOW needle biased out-of-view in ALPHA mode	1/2			X				X										
6 ⚠1	AP A (B) bat handle locked-off. YAW SAS FAIL light (same side) on. "Hard Fail."	1/2		1/2							X		1/2			B/A	X	1/2	
7 ⚠1	AP A (B) bat handle locked-off. YAW SAS FAIL light (same side) comes on during turn coordination			1/2						1/2	X		1/2					1/2	
8	Both AP bat handles locked-off in TAKEOFF mode only																		X

⚠1 **NOTE**
Replace yaw cmptr-1 (-2) after faulted (shorted) LRU is replaced. Replacing a yaw cmptr before checking for short ckt may result in burning out a fusistor in the new cmptr

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Autopilot CWS/CMD Mode Fault Matrix
Figure 103 (Sheet 1)

FAULTS — FIM — NO FIM

No.	Problem (AP A or B)	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: PC	RC	YC	CONT WHL	AP SERVO SOV	AP SERVO EHV	AP SERVO	ROLL SERVO PRESS SOV	ROLL SERVO AP PRESS SOV	ROLL SERVO EHV	ROLL SERVO	AIL POSN XDCR	Continuity Check or Replace: ROLL HOOK SW	AIL AUTH LIMIT SW-2	ASFDS ENG PNL	HI AUTH HOOK PRESS SW	HI AUTH HOOK ENG SOV
	AP A FIRM Codes With-1 → AP B FIRM Codes With-2; X = Use With Both FIRM Codes																	
"AP WILL NOT REMAIN ENGAGED FAULTS" (Ref. Fig. 106)																		
11	With TAKEOFF mode engaged, moving Capt (F/O) control column (pitch) disengages, either autopilot. Both autopilots operate normal with other control column movement	1 OR 2			C–F													
12	With TAKEOFF mode engaged, turning Capt (F/O) control wheel (roll) disengages either autopilot. Both autopilots operate normal with other control wheel movement		1 OR 2		C–F													
13	With TAKEOFF mode engaged, moving either control column (pitch) disengages autopilot A (B). Other autopilot operates normal with control column movement	1 OR 2																
14	With TAKEOFF mode engaged, turning either control wheel (roll) disengages autopilot A (B). Other autopilot operates normal with control wheel movement		1 OR 2															
15	Autopilot A (B) bat handle can be raised to CWS or CMS (no CMD modes engaged) but drops to OFF immediately or any time after engagement. A pitch or roll input command may be required to DISC autopilot	1–2	1–2	1–2		1–2	1–2	X	1–2	1–2	1–2	X	X	1–2	X	X	B–A	B–A
16	A/P LIMIT message with AP A (B) engaged in CWS or CMD. AP bat handle drops to OFF any time after engagement. (A pitch input cmd may be required to DISC AP.)					1–2												

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R R Autopilot CWS/CMD Mode Fault Matrix
Figure 103 (Sheet 2)

FAULTS — FIM — NO FIM

No.	Problem (AP A or B)	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: PC	RC	YC	AP SERVO	AP SERVO HOOK SW	AP SERVO HOOK SOV	VG	DG	Continuity Check or Replace: AFCS WARN IND	CONT WHL	YRG
	AP A FIRM Codes With - 1; AP B FIRM Codes With - 2; X — Use With Both FIRM Codes											
	"AP CWS CRUISE MODE FAULTS" (Ref. Fig 106)											
21	Capt (F/O) ADI ATTF HRZN shows quick excursions of 3-5° in pitch or roll. AP (same side) follows.							1/2				
22	Capt (F/O) HSI CMPS CARD shows quick excursions of 3-5° in hdg. AP (same side) follows.								1/2			
23	No CWS pitch response with either cont whl, AP A (B) engaged.	1/2										
24	No CWS pitch response with Capt cont whl, AP A (B) engaged.	1/2									C	
25	No CWS pitch response with F/O cont whl, AP A (B) engaged.	1/2									F	
26	No CWS roll response with either cont whl, AP A (B) engaged.		1/2									
27	No CWS roll response with Capt cont whl, AP A (B) engaged.		1/2								C	
28	No CWS roll response with F/O cont whl AP A (B) engaged.		1/2								F	
29	A/P LIMIT message with AP A (B) engaged. AP will follow VS pitch input cmd.				X	1/2						
30	A/P LIMIT message with AP A (B) engaged. AP will not follow VS pitch input card.	1/2			X		1/2					
31	A/P LIMIT message with either AP engaged. Both AP follow VS pitch input cmd.	1/2								C/F		
32	Incorrect CWS pitch response with either cont whl, AP A (B) engaged. Other AP operation normal.	1/2									C/F	
33	Incorrect CWS roll response with either control whl, AP A (B) engaged. Other AP operation normal.		1/2	1/2							C/F	1/2

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Autopilot CWS/CMD Mode Fault Matrix
Figure 103 (Sheet 3)

EFFECTIVITY: ALL

FAULTS → FIM → NO FIM

No.	Problem (AP A or B)	Troubleshoot Faulty LRU: Check FIM on LRU or on Front Pnl of FCES Cmptr								Continuity Chk or Replace		
	AP A FIRM Codes With -1 → AP B FIRM Codes With -2; X = Use With Both FIRM Codes	PC	RC	NA	TAC	ADC	AP SERVO	PF & TA		AIR IN HYDRO	RIGGING	CONT Y/HL
"AP CWS CRUISE MODE FAULTS (Cont)" (Ref. Fig. 106)												
34	AP A & B trips from CMD to CWS with very little turn pressure on Capt (F/O) cont whl. Other cont whl operation is normal.											C/F
35	AP A (B) trips from CMD to CWS with very little turn pressure on both cont whl.		1/2									
36	AP A (B) will not trip from CMD to CWS with over 15 pounds of turn force applied to Capt cont whl. Other cont whl operation is normal.											C
37	AP A (B) will not trip from CMD to CWS with over 15 pounds of turn force applied to F/O cont whl. Other cont whl operation is normal.											F
38	AP A (B) will not trip from CMD to CWS with over 15 pounds of turn force applied to both cont whl.		1/2									
39	AP A & B pitch mode (VS, ALT, IAS, MACH) will not release with 15 pounds of pitch force applied to Capt cont whl. Other cont whl operation is normal.											C
40	AP AB B pitch mode (VS, ALT, IAS, MACH) will not release with 15 pounds of pitch force applied to F/O cont whl. Other cont whl operation is normal.											F
40A	AP A & B pitch mode (VS, ALT, IAS, MACH) will not release with 15 pounds of pitch force applied to both cont whl.	1/2										

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Autopilot CWS/CMD Mode Fault Matrix
Figure 103 (Sheet 4)

FAULTS — FIM — NO FIM

No.	Problem (AP A or B)	Troubleshoot Faulty LRU						
	AP A FIRM Codes With -1 / AP B FIRM Codes With -2 / X = Use With Both FIRM Codes	Check FIM on LRU or on Front Pnl of FCES Cmptr				Continuity Chk or Replace		
		PC	NA	ADC	VG/INU	AIR IN HYDRO	RIGGING	SERVO RIGGING
"AP CAUSES ACFT TO PORPOISE FAULTS" (Ref. Fig. 109)								
41	Aircraft porpoises when AP A (B) is engaged in pitch CMD mode. No other cockpit indications		X					
42	Aircraft porpoises when AP A (B) is engaged in pitch CMD mode. CADC instr (same side) are erratic or do not agree with other side			1/2				
43	Aircraft porpoises when either AP is engaged. OK when one pitch trim sys is turned off	1/2			1/2	B/A		
44	Aircraft porpoises when AP A (B) is engaged. No pitch CMD modes engaged. ADI artificial horizon (same side) may show excursions of 3-5° in pitch and roll				1/2			
45	Aircraft porpoises when either AP is engaged. OK when one pitch trim system is turned off. (Control column moves approx. 1 inch in 2-3 seconds)	1/2					X	X
46	Aircraft porpoises when either AP is engaged. (Control column moves approx. 1 inch in 2-3 seconds)	1/2					X	
"CONTROL COLUMN BUZZ WITH AP TURNED ON FAULTS" (Ref. Fig. 110)								
47	Control column buzz when AP A (B) is engaged. Control column normal when other autopilot is engaged.				1/2	B/A	X	
48	Control column buzz when either AP is engaged.				1/2/3	B/A	X	

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R Autopilot CWS/CMD Mode Fault Matrix
R Figure 103 (Sheet 5)

R EFFECTIVITY: ALL
R
001B

Abbreviations		Remove and Install Ref.	
		Chapt	Page
AIR IN HYDRO	Bleed Hydro B for AP A, or Hydro A for AP B		
ADC	Air Data Computer	34-14-01	401
AIL AUTH LIMT SW-1/-2	Aileron Authority Limit Switch No. 1/No. 2 (Autopilot Limiter Sw Mechanism)	27-11-38	401
AIL POSN XDCR	Left Inboard Aileron Dual Position Transducer	22-13-03	401 401
AFCS WARN IND	AFCS Warning Indicator	22-10-06	401
AP DISC SW	Autopilot Disconnect Switch (Control Wheel)	22-10-21	401
APFDS ENG PNL	APFDS Engage Panel	22-10-01	401
AP PRESS SW	Rudder Autopilot Servo Pressure Switch	27-21-24	401
AP SERVO	Stabilizer Autopilot Control Servo	22-11-05	401
AP SERVO EHV	AP A (B) Hyd Sys B (A) EHV	22-11-08	401
AP SERVO HOOK SW	AP A (B) Hyd Sys B (A) Low Auth Hook Press Sw	22-11-09	401
AP SERVO HOOK SOV	AP A (B) Hyd Sys B (A) Low Auth Eng Sol Valve	22-11-07	401
AP SERVO SOV	AP A (B) Hyd Sys B (A) Press Sol Valve	22-11-07	401
CC	Compass Coupler	34-22-03	401
CONT WHL	Control Wheel	27-11-00	401
DG	Directional Gyro	34-22-04	401
FLAP PDU SB	Flap PDU Switch Box	27-51-12	401
HI AUTH HOOK ENG SOV	High Authority Hook Engage Shutoff Valve	22-11-07	401
HI AUTH HOOK PRESS SW	High Authority Hook Pressure Switch	22-11-09	401
INU	Inertial Navigation Unit	34-43-03	401
ISU	Inertial Sensor Unit	34-43-03	401
NA	Normal Accelerometer	22-11-02	401
PC	Pitch Computer	22-11-01	401
RC	Roll Computer	22-13-01	401
RIGGING	Perform Stab Rigging Procedure	27-41-00	401
ROLL HOOK SW	AP A (B) Hyd Sys B (A) Hook Press Sw	27-11-37	501
ROLL SERVO	L Inbd Ail Servo Cont Module	27-11-17	401
ROLL SERVO AP PRESS SOV	AP A (B) Hyd Sys B (A) Press SOV	22-11-20	401
ROLL SERVO EHV	AP A (B) Hyd Sys B (A) EHV	22-11-21	401
ROLL SERVO PRESS SOV	Hyd Sys B (A) Servo Press SOV	27-11-20	401
RUD SVO	Rudder Servo Module	27-21-07	401
RUD POSN XDCR	Rudder Dual Position Transducer	22-15-03	401
SC	Speed Control Computer	22-31-07	401
VG	Vertical Gyro	34-21-04	401
YC	Yaw Computer	22-15-01	401
YRG	Yaw Rate Gyro	22-15-02	401
X	One LRU Common to Both Sys		
1 or A or C (Capt)	No. 1 LRU Associated with Sys 1 Problem		
2 or B or F (F/O)	No. 2 LRU Associated with Sys 2 Problem		
3	No. 3 LRU Common to Both Sys		

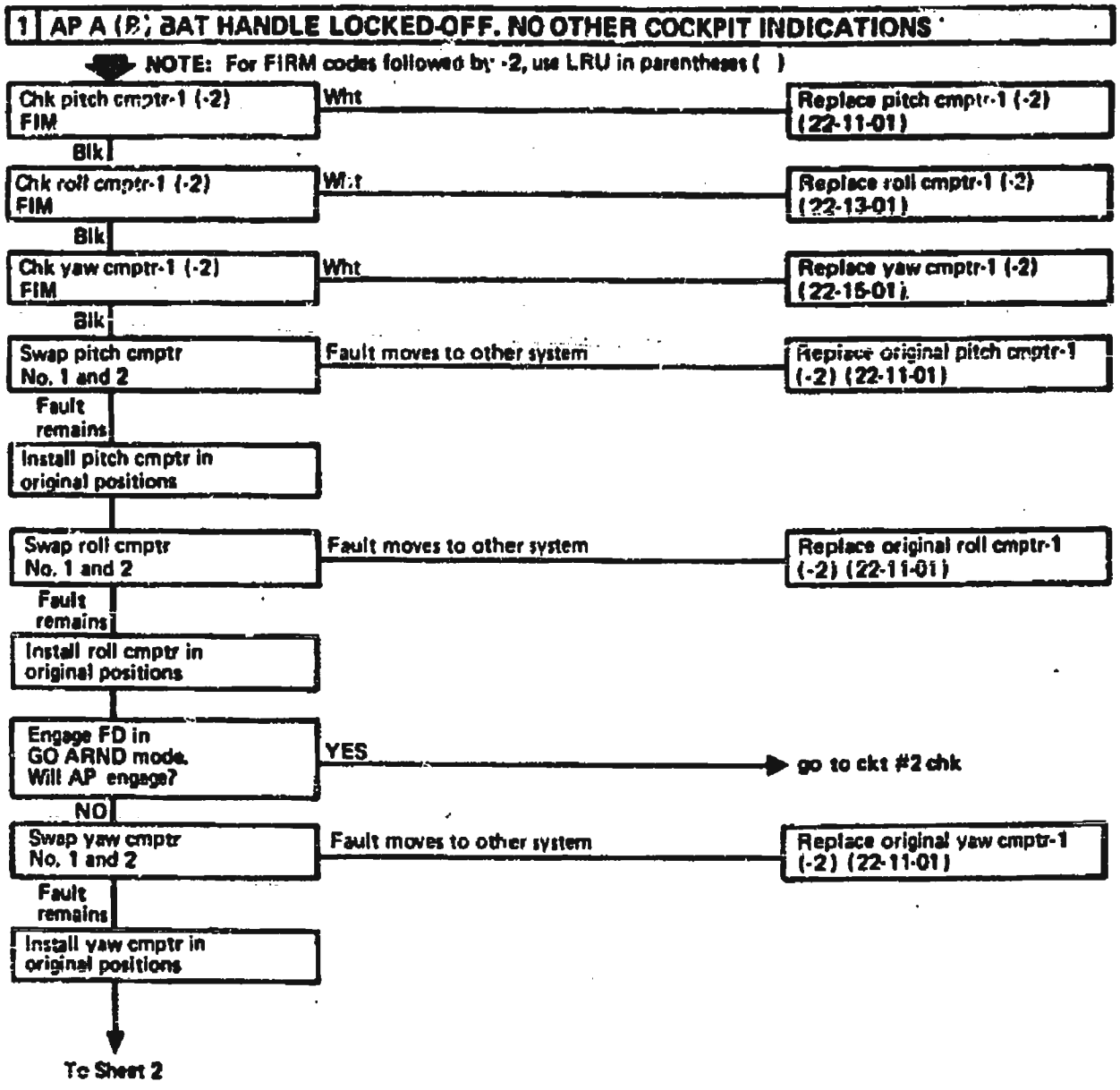
HOW TO USE

1. Find flight squawk in FAULTS column
2. Check FIM or LRU listed in FIM column related to FAULTS.
   Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 102 and 103

M1-0106-22-1001

R R Autopilot CWS/CMD Mode Fault Matrix
Figure 103 (Sheet 6)

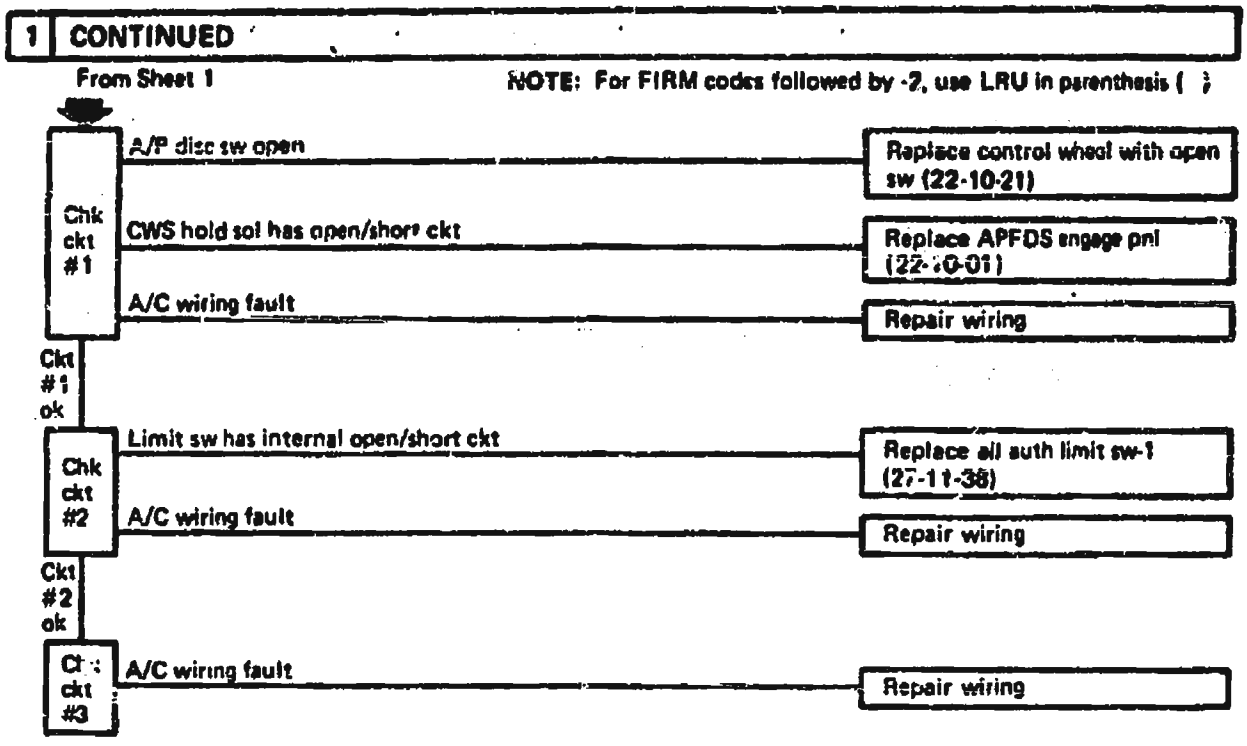
R EFFECTIVITY: ALL


1 AP A (B) BAT HANDLE LOCKED-OFF. NO OTHER COCKPIT INDICATIONS
NOTE: For FIRM codes followed by -2, use LRU in parentheses ( )
Chk pitch cmptr-1 (-2) FIM
Wht
Replace pitch cmptr-1 (-2) (22-11-01)
Blk
Chk roll cmptr-1 (-2) FIM
Wht
Replace roll cmptr-1 (-2) (22-13-01)
Blk
Chk yaw cmptr-1 (-2) FIM
Wht
Replace yaw cmptr-1 (-2) (22-15-01)
Blk
Swap pitch cmptr No. 1 and 2
Fault moves to other system
Replace original pitch cmptr-1 (-2) (22-11-01)
Fault remains
Install pitch cmptr in original positions
Swap roll cmptr No. 1 and 2
Fault moves to other system
Replace original roll cmptr-1 (-2) (22-11-01)
Fault remains
Install roll cmptr in original positions
Engage FD in GO ARND mode. Will AP engage?
YES
go to ckt #2 chk
NO
Swap yaw cmptr No. 1 and 2
Fault moves to other system
Replace original yaw cmptr-1 (-2) (22-11-01)
Fault remains
Install yaw cmptr in original positions
To Sheet 2

M1-0103-22-1002

R R Autopilot Locked-Off Faults
Figure 104 (Sheet 1)

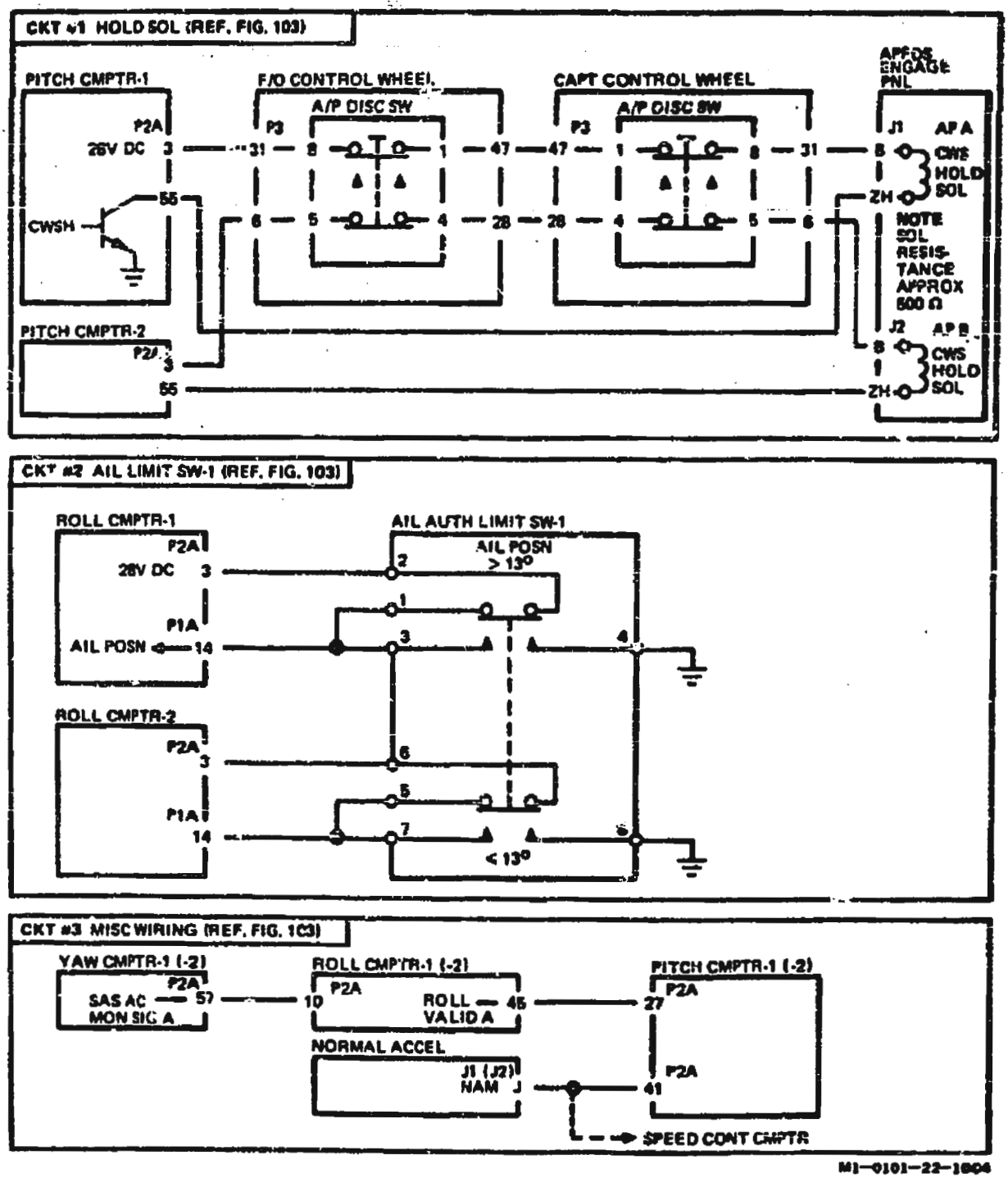
R R 001B EFFECTIVITY: ALL


1 CONTINUED
From Sheet 1
NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( )
Chk ckt #1
A/P disc sw open
Replace control wheel with open sw (22-10-21)
CWS hold sol has open/short ckt
Replace APFDS engage pnl (22-10-01)
A/C wiring fault
Repair wiring
Ckt #1 ok
Chk ckt #2
Limit sw has internal open/short ckt
Replace all auth limit sw-1 (27-11-38)
A/C wiring fault
Repair wiring
Ckt #2 ok
Chk ckt #3
A/C wiring fault
Repair wiring

M1-0102-22-1003

1 CONTINUED

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( )



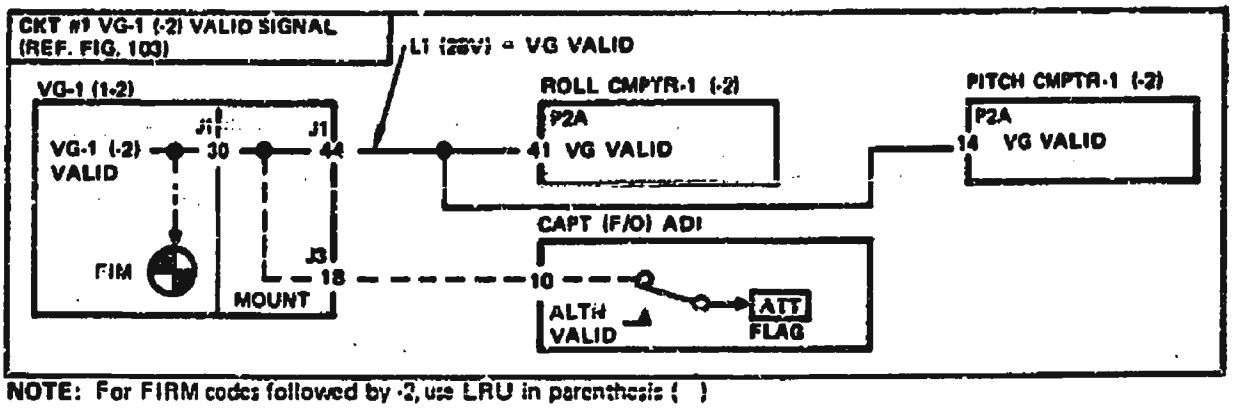
M1-0101-22-1804

R Autopilot Locked-Off Faults
R Figure 104 (Sheet 3)

R EFFECTIVITY: ALL
R
R
001B

2 AP A (B) BAT HANDLE LOCKED-OFF. ATT FLAG IN-VIEW ON ADI (SAME SIDE). FD FLAG IN-VIEW, CMD BAR OUT-OF-VIEW ON ADI (SAME SIDE) WHEN FD TURNED ON

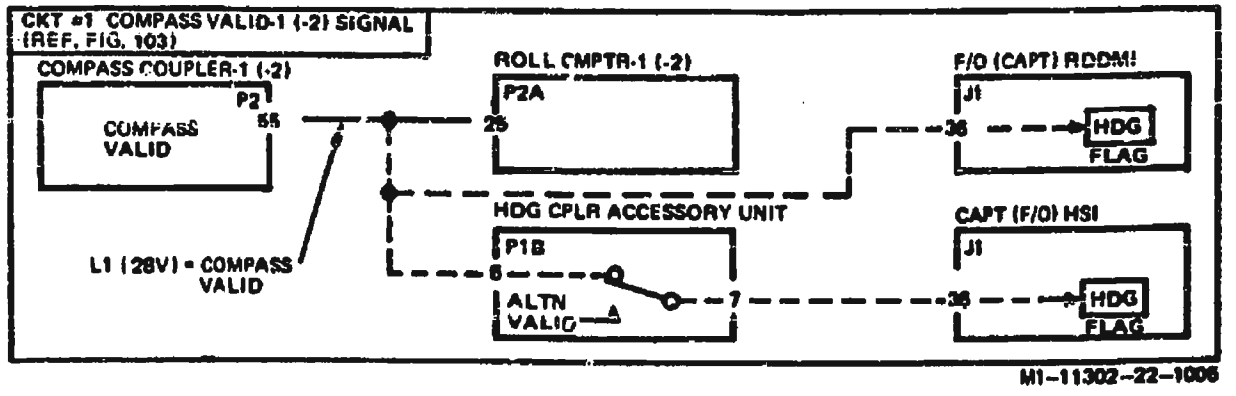
Loss of VG-1 (-2) valid signal (Ref. ckt #1) → Replace VG-1 (-2) (34-21-04)



NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( )

3 AP A (B) BAT HANDLE LOCKED-OFF. HDG FLAG IN-VIEW ON HSI (SAME SIDE) AND ON RDDMI (OPPOSITE SIDE). FD FLAG IN-VIEW, CMD BAR OUT-OF-VIEW ON ADI (SAME SIDE) WHEN FD TURNED ON

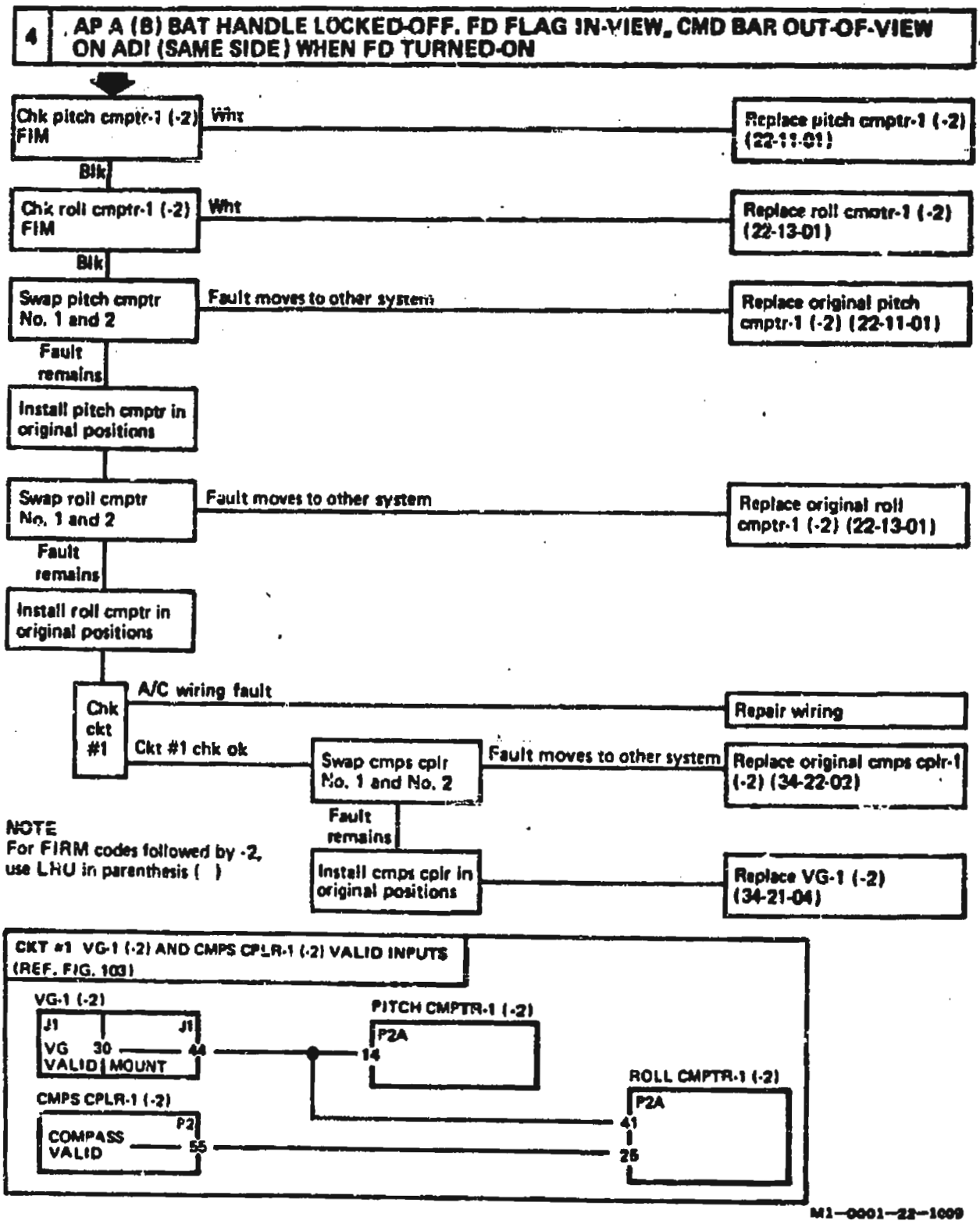
Chk cmps cplr-1 (-2) FIM
- Yel → Replace cmps cplr-1 (-2) (34-22-03)
- Blk → Chk DG-1 (-2) FIM
  - Yel → Replace DG-1 (-2) (34-22-04)
  - Blk → Chk ckt #1
    - Ckt #1 chk ok → Replace cmps cplr-1 (-2) (34-22-03)
    - A/C wiring fault → Repair wiring



M1-11302-22-1006

Autopilot Locked-Off Faults
Figure 104 (Sheet 4)

EFFECTIVITY: ALL



Autopilot Locked-Off Faults
Figure 104 (Sheet 5)

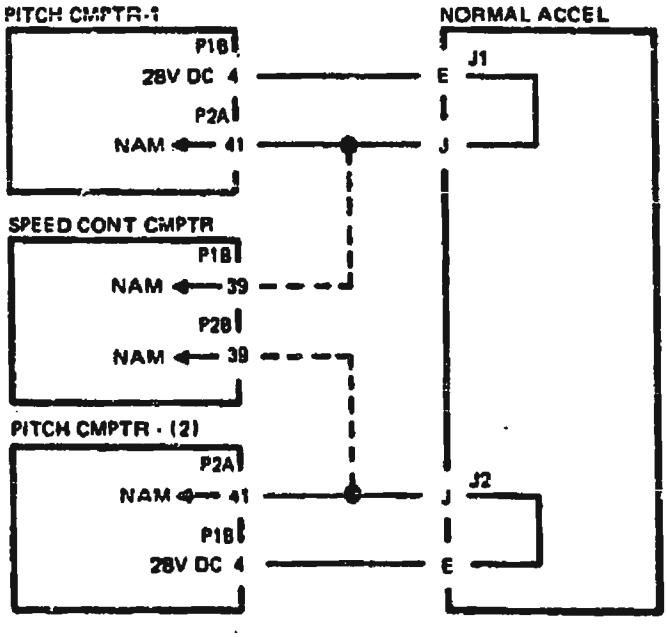
EFFECTIVITY: ALL

5 AP A (B) BAT HANDLE LOCKED-OFF. ATS FAIL LIGHT (SAME SIDE) COMES ON AND ADI (SAME SIDE) FAST/SLOW NEEDLE BIASED OUT-OF-VIEW IN ALPHA MODE

Chk ckt #1	Normal accel has internal open ckt	Replace normal accel (22-11-02)
	A/C wiring fault	Repair wiring
	Ckt #1 chk ok	Replace in following order: ● Pitch cmptr-1 (-2) (22-11-01). ● Speed cont cmptr (22-31-07)

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( )

CKT #1 NORMAL ACCEL VALID INPUT (REF. FIG. 103)



M1-0100-22-1011

Autopilot Locked-Off Faults
Figure 104 (Sheet 6)

EFFECTIVITY: ALL

001B

6 AP A (B) BAT HANDLE LOCKED-OFF. YAW SAS FAIL LIGHT (SAME SIDE) ON, "HARD FAIL"

FAULTY YAW CMPTR DC POWER SUPPLY CKT
- Yaw cmptr-1 (-2) FIM wht.
- Ensure that flaps are up and all applicable CB are opened before checking continuity

NOTE
1 Replace yaw cmptr-1 (-2) after faulted (shorted) LRU is replaced. Replacing a yaw cmptr before checking for short ckt may result in burning out a fusister in the new cmptr

2 For FIRM codes followed by -2 use LRU in parenthesis ( )

DETERMINE FAULTED LRU

- Remove yaw cmptr-1 (-2).
- Chk yaw cmptr-1 (-2) P1A-6 and P1B-6 to gnd (Ref. ckt #1).
- Is resistance less than 10 ohms (short)?

Yes (P1A-6 short to gnd) → Replace shorted LRU(1):
- Flap PDU sw box-1 (-2) (27-51-12).
- Pitch cmptr-1 (-2) (22-11-01).
- AP A (B) hyd sys B (A) press sw (27-21-24).
- Rudder servo module (27-21-07)

Yes (P1B-6 short to gnd) → Replace shorted LRU(1):
- Flap PDU sw box-2 (-1) (27-51-12).
- Pitch cmptr-1 (-2) (22-11-01)

NO → Is there continuity between yaw cmptr-1 (-2) P1A-6 and P2A-26 (Ref. ckt #1)?

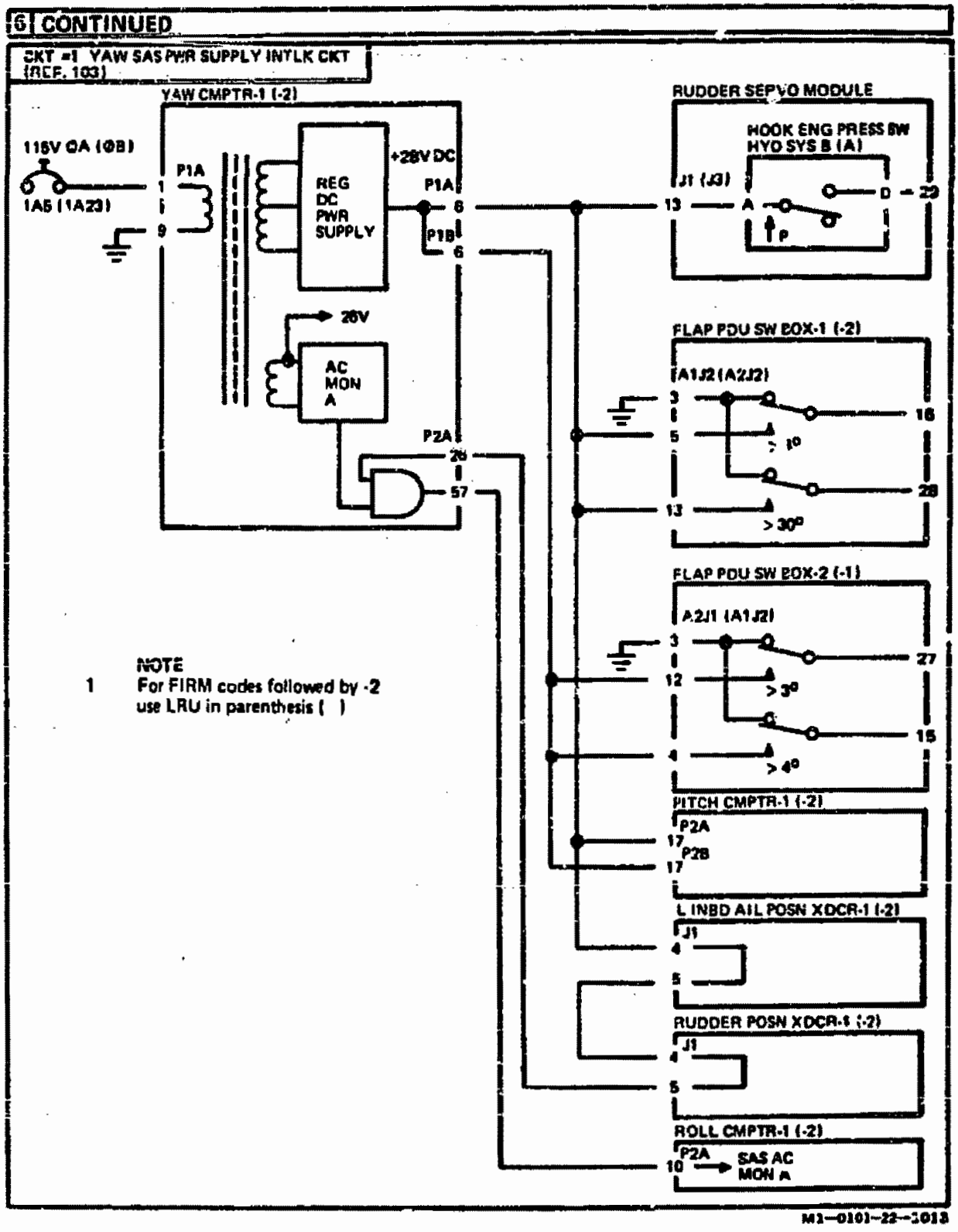
No (open ckt) → Replace open LRU:
- Rudder dual posn xdcr-1 (-2) (22-15-03).
- L inbd ail posn xdcr-1 (-2) (22-13-03).
- Repair wiring

YES → Replace yaw cmptr-1 (-2) (22-15-01)

M1-0101-22-1012

R R Autopilot Locked-Off Faults
Figure 104 (Sheet 7)

R R 001B EFFECTIVITY: ALL



R R Autopilot Locked-Off Faults
Figure 104 (Sheet 8)

R R 001B EFFECTIVITY: ALL

7 AP A (B) BAT HANDLE LOCKED-OFF. YAW SAS FAIL LIGHT (SAME SIDE) COMES ON DURING TURN COORDINATION

FAULT YAW CMPTR 26V AC PWR CKT
- Yaw SAS servo-1 (-2) FIM wht
- Ensure that all applicable CB are opened before checking continuity

⚠1 **NOTE**
Replace yaw cmptr-1 (-2) after faulted (shorted) LRU is replaced. Replacing a yaw cmptr before checking for short ckt may result in burning out fusister in the new cmptr

2 For FIRM codes followed by -2 use LRU in parenthesis ( )

DETERMINE FAULTED LRU

- Remove yaw cmptr-1 (-2).
- Chk yaw cmptr-1 (-2) P1A-2 to gnd (Ref. ckt #1.
- Is resistance less than 100 ohm (short)?

Yes (P1A-2 short to gnd) → Replace shorted LRU⚠1:
- Yaw rate gyro-1 (-2) (22-15-02).
- L inbd ail posn xdcr-1 (-2) (22-13-03).
- Rudder dual posn xdcr-1 (-2) (22-15-03).
- Rudder servo module (27-21-07)

NO → Replace yaw cmptr-1 (-2) (22-15-01)

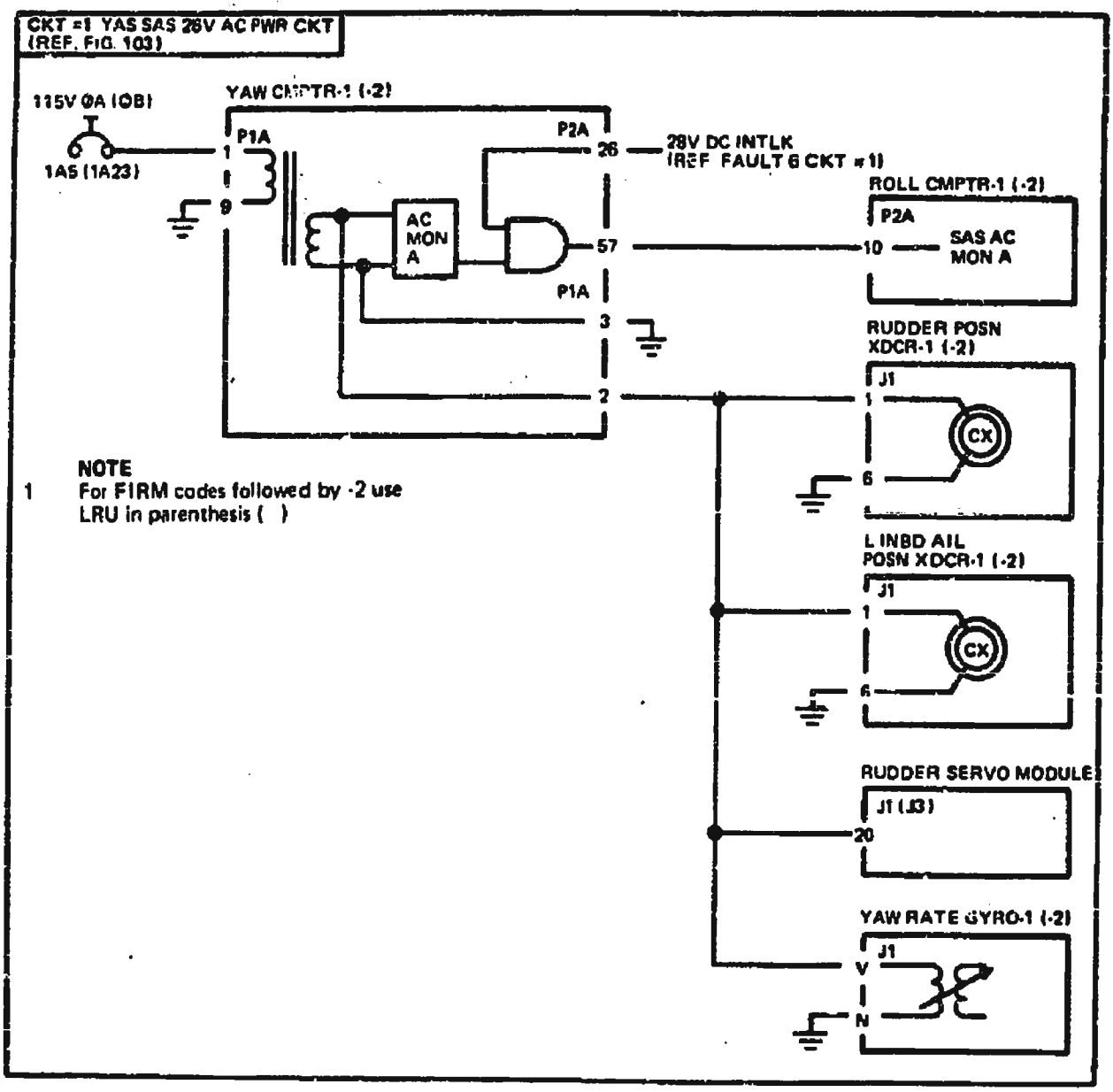
M1-0100-22-1014

Autopilot Locked-Off Faults
Figure 104 (Sheet 9)

EFFECTIVITY: ALL

001B

7 CONTINUED



M1-0101-22-1015

R Locked-Off Faults
R Figure 104 (Sheet 10)

R EFFECTIVITY: ALL

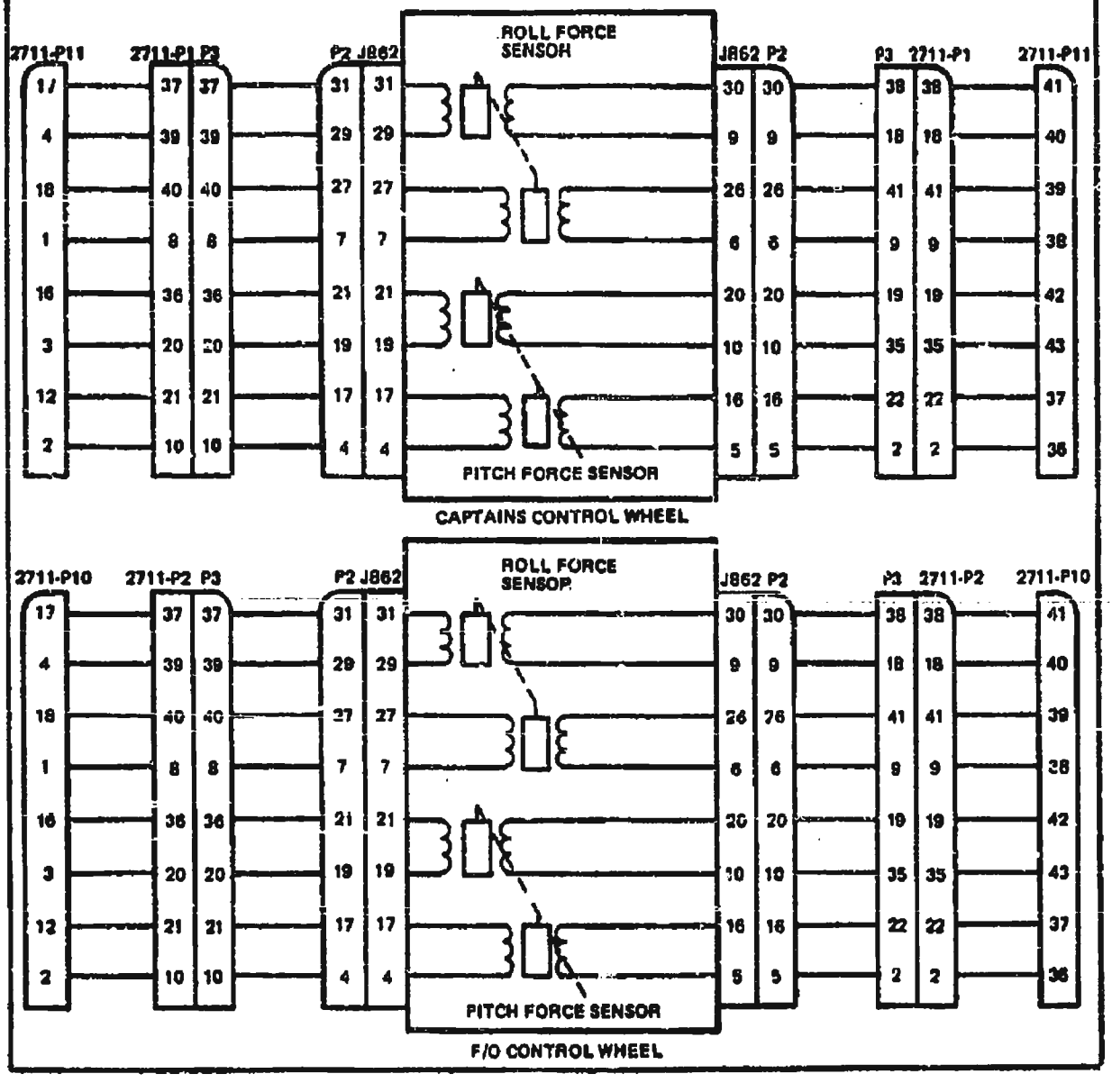
8 BOTH AUTOPILOT BAT HANDLES LOCKED-OFF IN TAKEOFF MODE ONLY

Chk ckt #1

Short ckt between primary and secondary of control wheel force sensor

Replace Capt (F/O) control wheel (27-11-00)

CKT #1 CONTROL WHEEL FORCE SENSOR SIGNAL (REF. 22-00-00, SCHEM 6 & 9)



M1-0002-22-1158

R R Autopilot Locked-Off Faults
Figure 104 (Sheet 11)

EFFECTIVITY: ALL

001B

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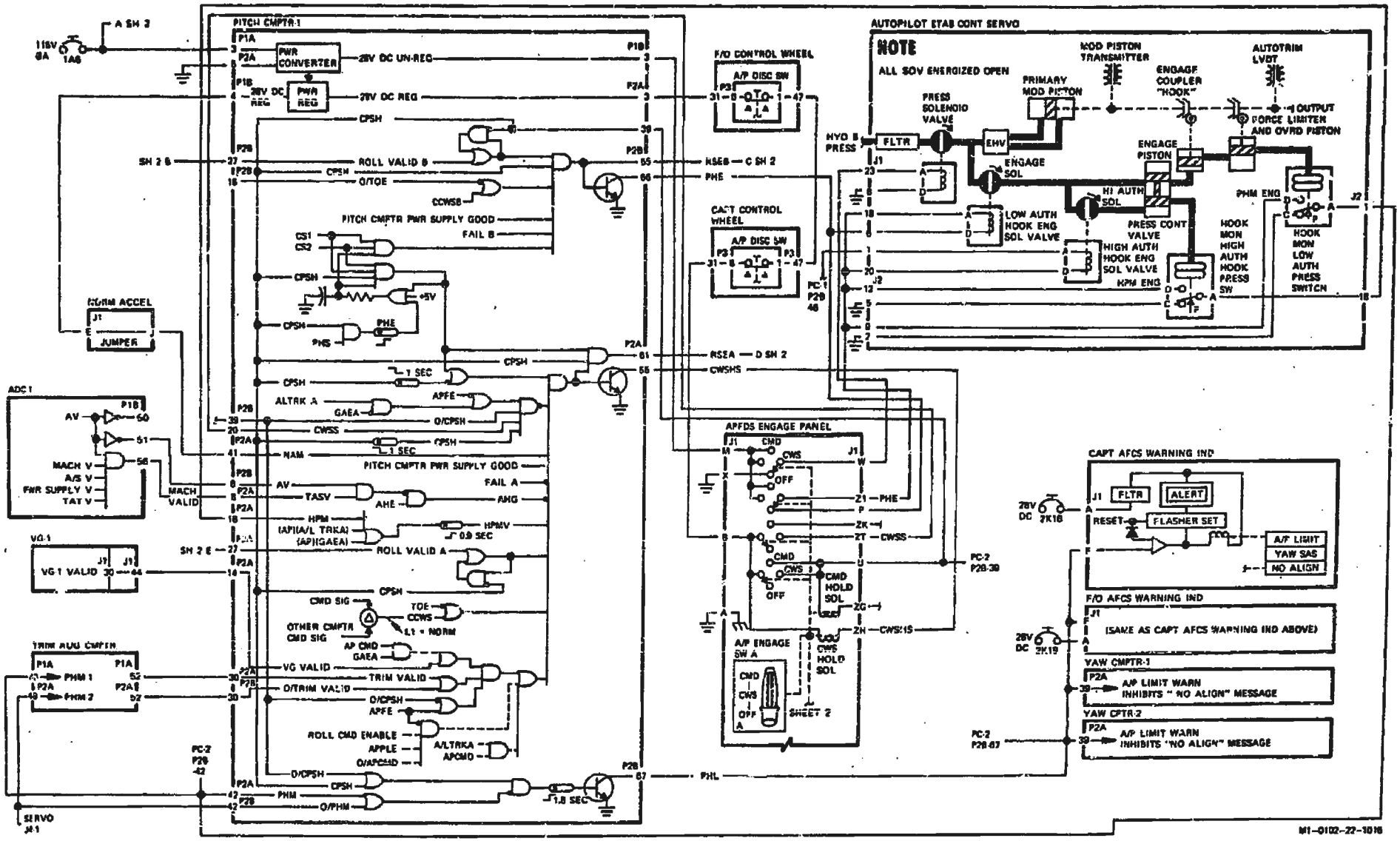
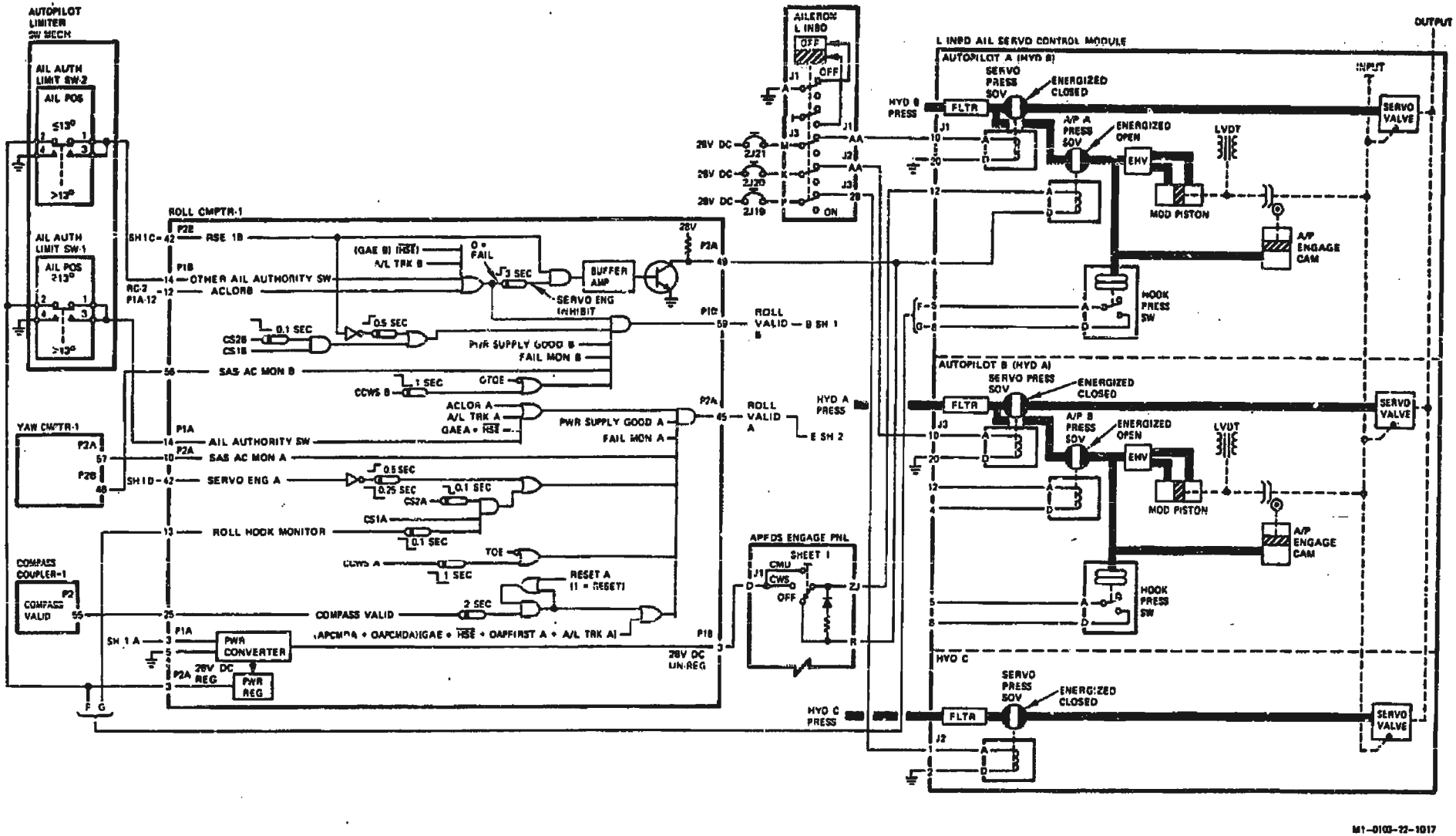


Autopilot Engage Logic Simplified Schematic
Figure 105 (Sheet 1)

EFFECTIVITY: ALL

0018



Autopilot Engage Logic Simplified Schematic
Figure 105 (Sheet 2)

EFFECTIVITY: ALL

0018

11	WITH TAKEOFF MODE ENGAGED, MOVING CAPT (F/O) CONTROL COLUMN (PITCH) DISENGAGES EITHER AUTOPILOT. BOTH AUTOPILOTS OPERATE NORMAL WITH OTHER CONTROL COLUMN MOVEMENT.

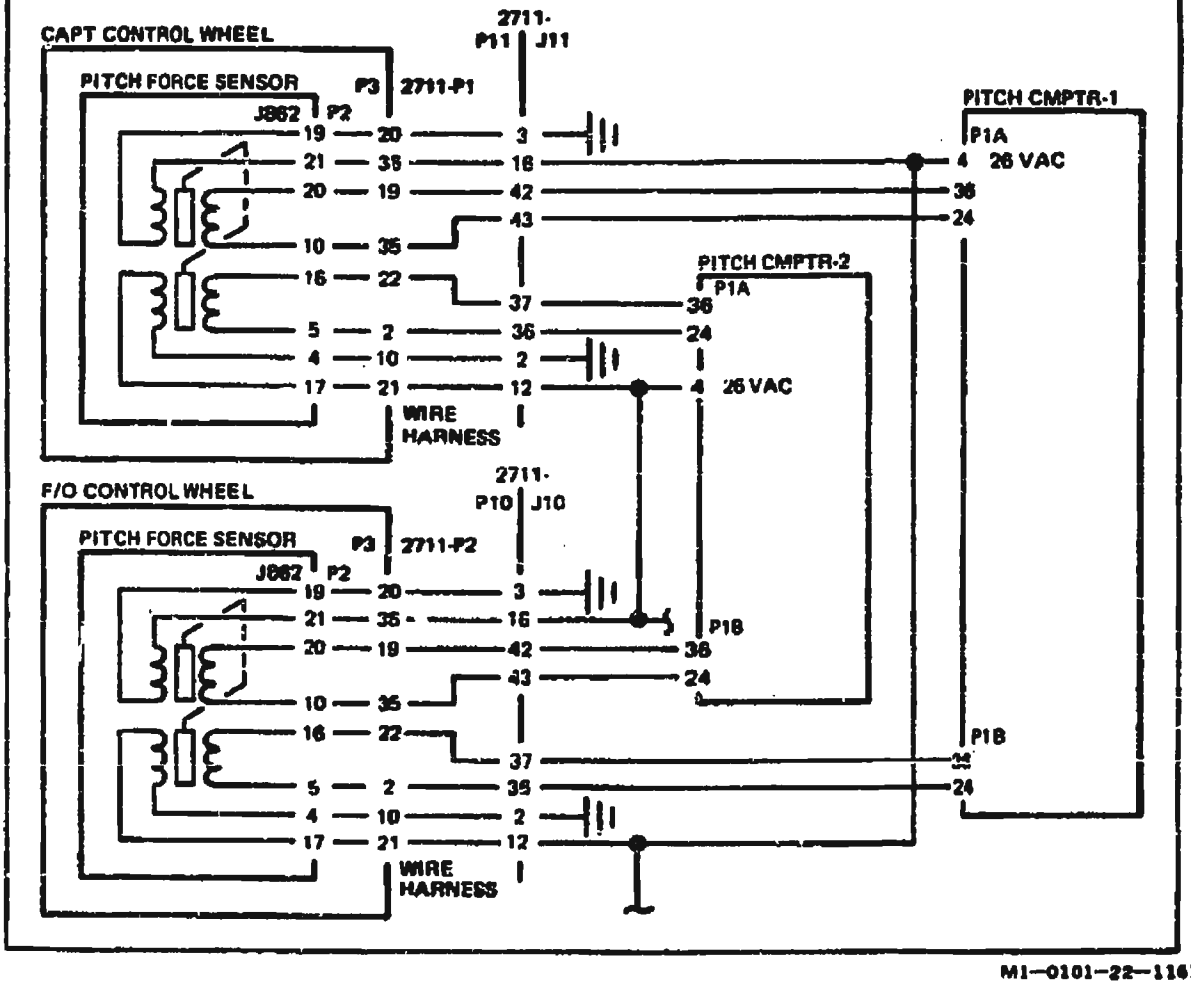
Chk ckt #1

- Control wheel has internal open/short ckt → Replace Capt (F/O) control wheel (27-11-00)
- A/C wiring fault → Repair wiring
- Ckt #1 chk ok → • Replace pitch cmptr-1 (22-11-01) • If problem persists, replace pitch cmptr-2 (22-11-01)

NOTE

1. This fault should set PITCH COMP 1 or 2 FIM on FCES cmptr.
2. For FIRM codes followed by -2 use LRU in parenthesis ( ).

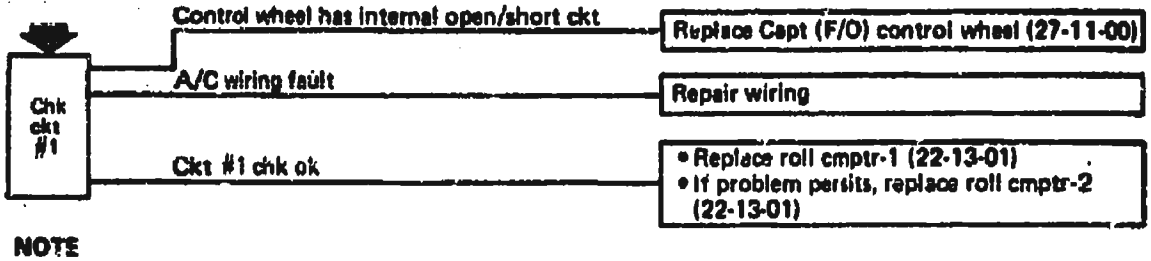
CKT #1 CONTROL WHEEL STEERING PITCH INPUT (REF. FIG. 105)



M1—0101—22—1167

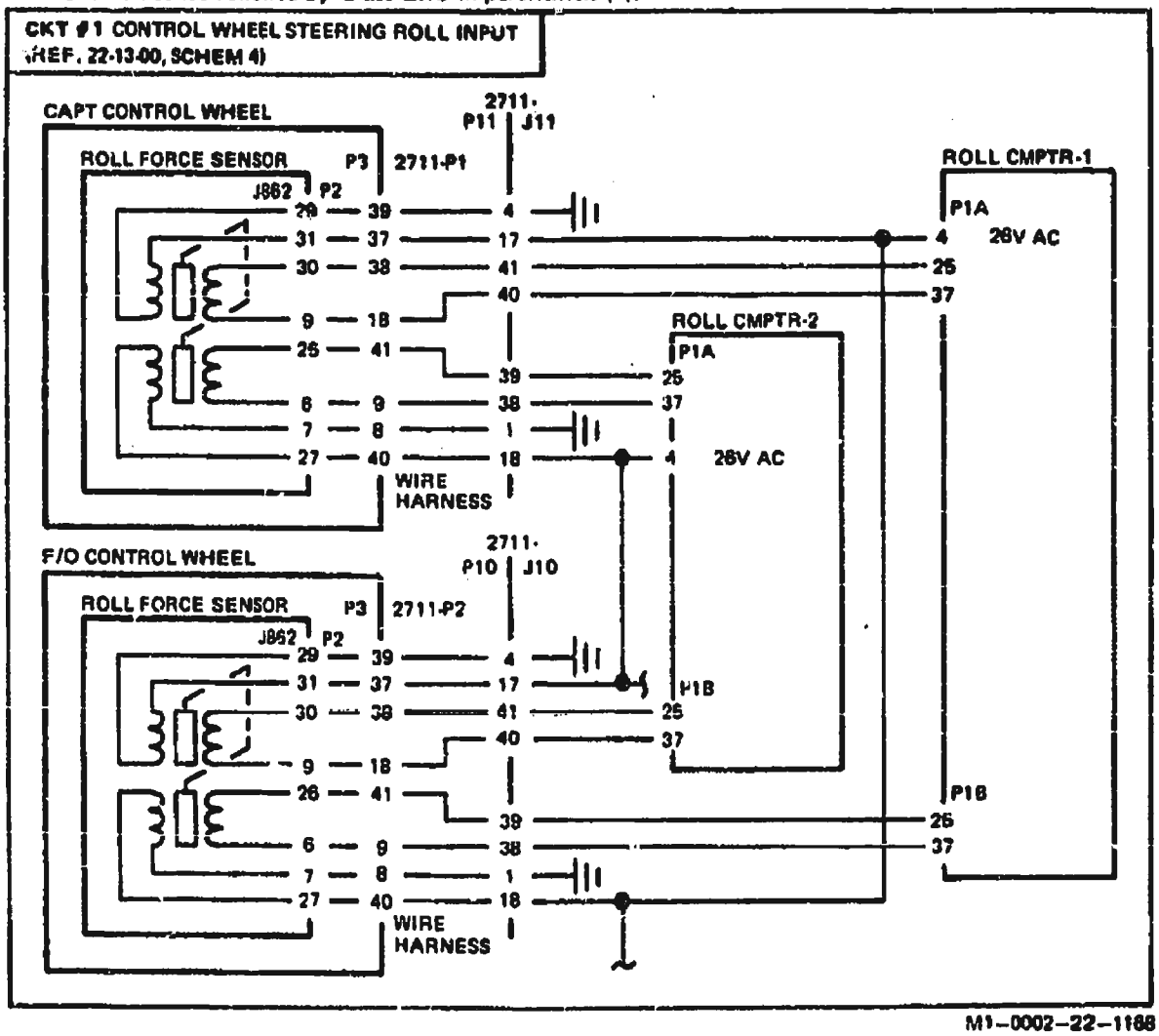
R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 1)

12	WITH TAKEOFF MODE ENGAGED, TURNING CAPT (F/O) CONTROL WHEEL (ROLL) DISENGAGES EITHER AUTOPILOT. BOTH AUTOPILOTS OPERATE NORMAL WITH OTHER CONTROL WHEEL MOVEMENT.


Chk ckt #1
Control wheel has internal open/short ckt
Replace Capt (F/O) control wheel (27-11-00)
A/C wiring fault
Repair wiring
Ckt #1 chk ok
• Replace roll cmptr-1 (22-13-01)
• If problem persits, replace roll cmptr-2 (22-13-01)

NOTE

1 This fault should set ROLL COMP or 2 FIM on FCES cmptr.
2 For FIRM codes followed by -2 use LRU in parenthesis ( ).



M1-0002-22-1188

R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 2)

EFFECTIVITY: ALL

001B

13	WITH TAKEOFF MODE ENGAGED, MOVING EITHER CONTROL COLUMN (PITCH) DISENGAGES AUTOPILOT A (B). OTHER AUTOPILOT OPERATES NORMAL WITH CONTROL COLUMN MOVEMENT.

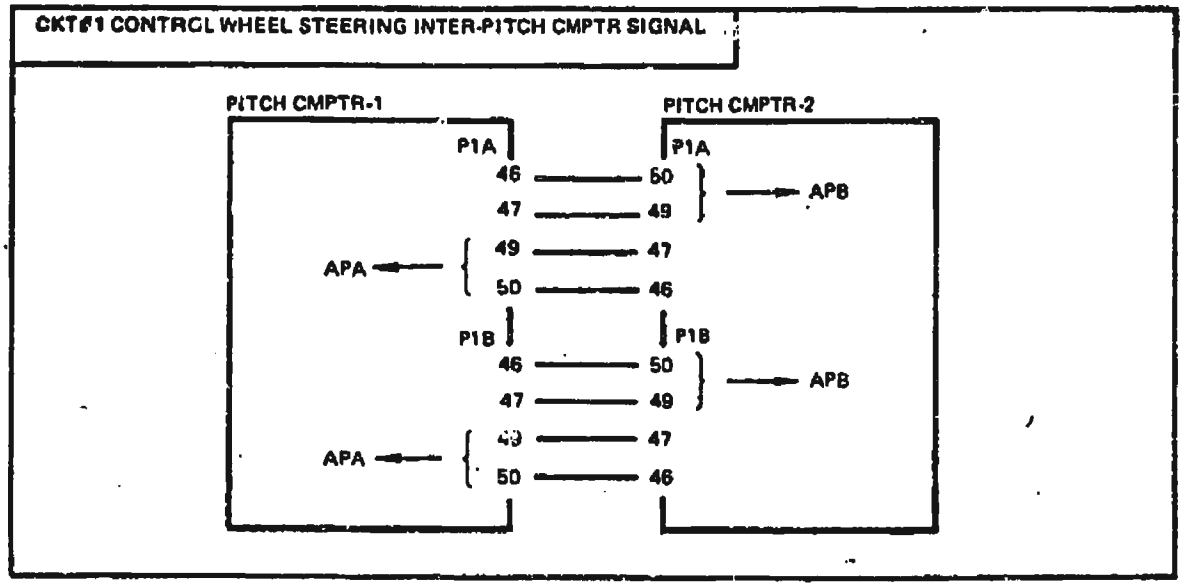
Chk Ckt #1

A/C wiring fault → Repair wiring

Ckt #1 chk ok →
- Replace pitch cmptr -1 (22-11-01)
- If problem persists, replace pitch cmptr -2 (22-11-01)

NOTE

1 This fault should set PITCH COMP 1 or 2 FIM on FCES cmptr.
2 For FIRM codes followed by -2 use LRU in parenthesis ( ).



M1-0001-22-1189

R R Autopilot Will Not Remain Engaged Faults
Figure 106 (Sheet 3)

EFFECTIVITY: ALL

001B

14 WITH TAKEOFF MODE ENGAGED, TURNING EITHER CONTROL WHEEL (ROLL) DISENGAGES AUTOPILOT A (B). OTHER AUTOPILOT OPERATES NORMAL WITH CONTROL WHEEL MOVEMENT.

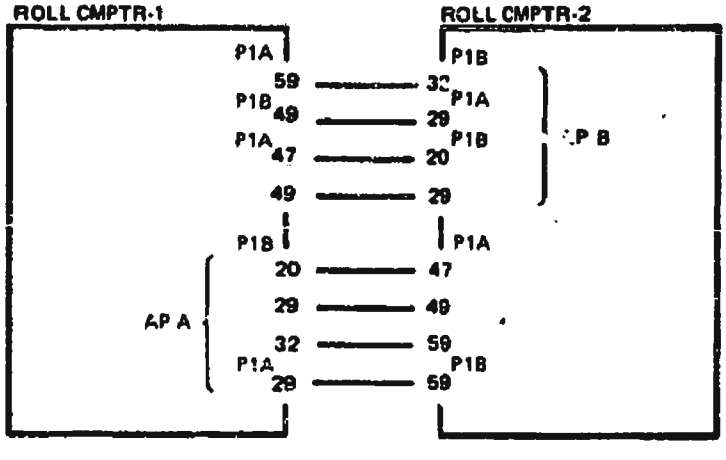
Chk ckt #1

A/C wiring fault → Repair wiring

Ckt #1 chk ok →
- Replace roll cmptr-1 (22-13-01)
- If problem persists, replace roll cmptr-2 (22-13-01)

NOTE
1 This fault should set ROLL comp 1 or 2 FIM on FCES cmptr.
2 For FIRM codes followed by -2 use LRU in parenthesis ( ).

CKT #1 CONTROL WHEEL STEERING INTER-ROLL CMPTR SIGNAL

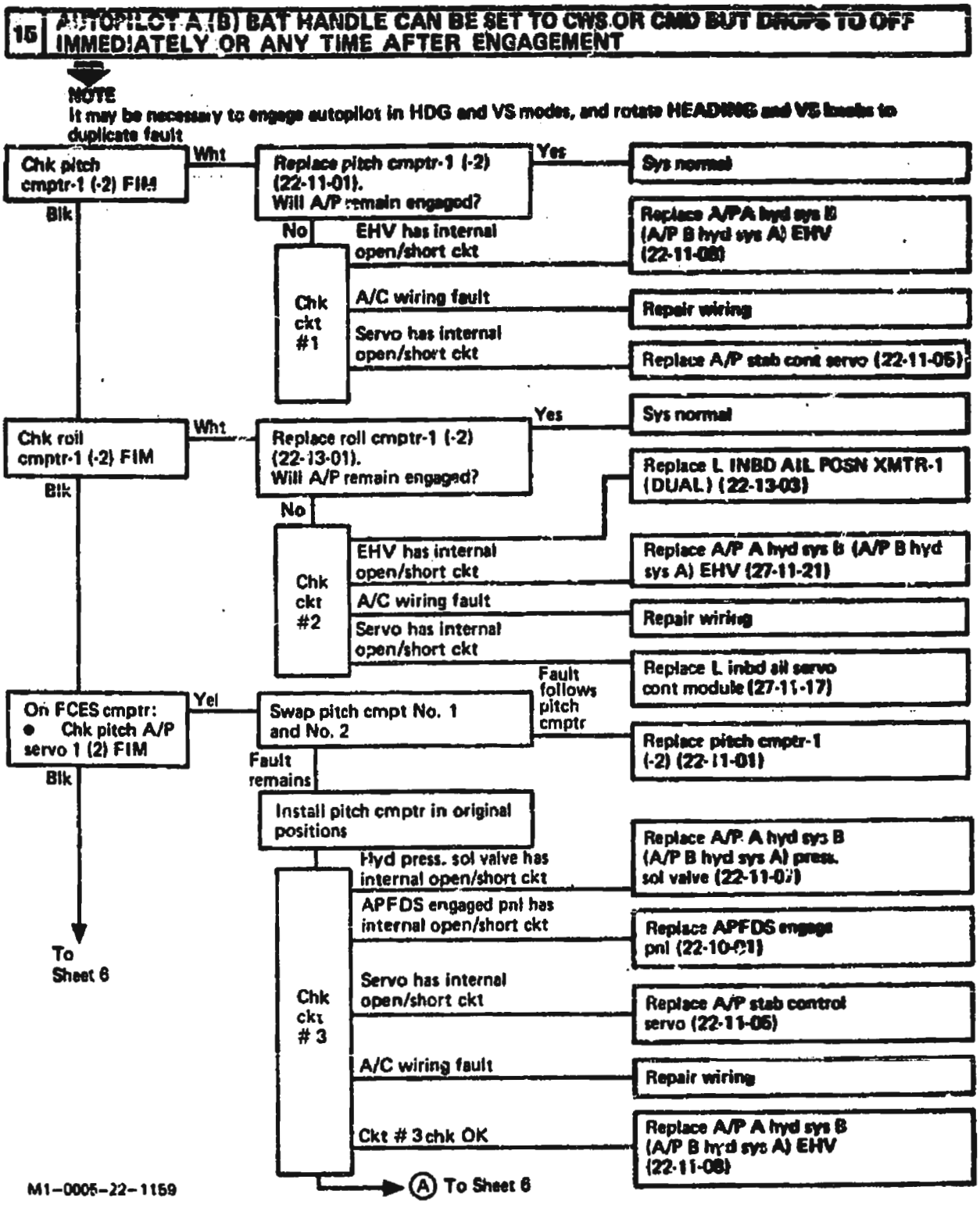


M1-0001-22-1170

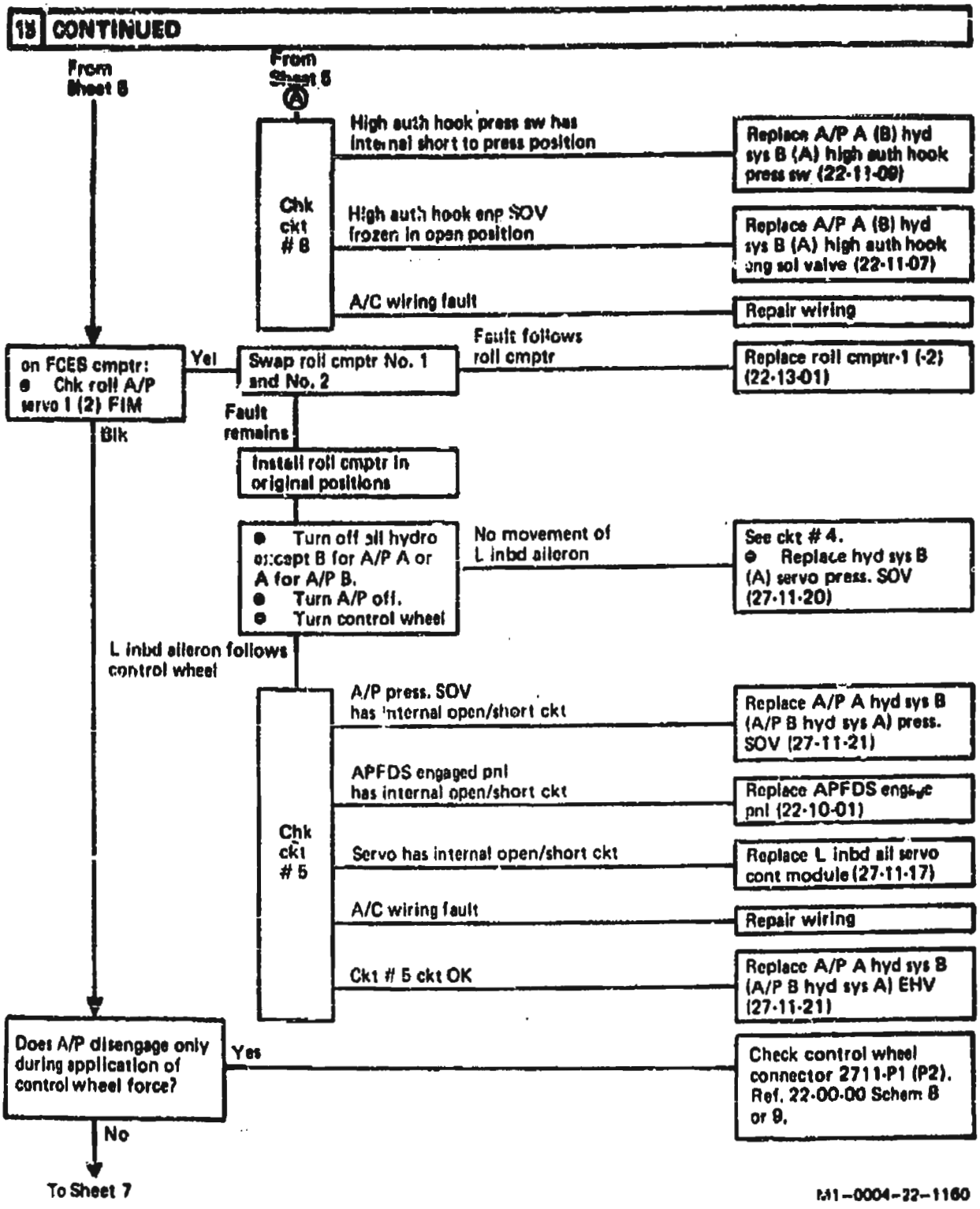
R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 4)

EFFECTIVITY: ALL

0018


15 AUTOPILOT A (B) BAT HANDLE CAN BE SET TO CWS OR CMD BUT DROPS TO OFF IMMEDIATELY OR ANY TIME AFTER ENGAGEMENT
NOTE
It may be necessary to engage autopilot in HDG and VS modes, and rotate HEADING and VS knobs to duplicate fault
Chk pitch cmptr-1 (-2) FIM
Wht
Blk
Replace pitch cmptr-1 (-2) (22-11-01). Will A/P remain engaged?
Yes
Sys normal
No
Chk ckt #1
EHV has internal open/short ckt
Replace A/P A hyd sys B (A/P B hyd sys A) EHV (22-11-08)
A/C wiring fault
Repair wiring
Servo has internal open/short ckt
Replace A/P stab cont servo (22-11-05)
Chk roll cmptr-1 (-2) FIM
Wht
Blk
Replace roll cmptr-1 (-2) (22-13-01). Will A/P remain engaged?
Yes
Sys normal
Replace L INBD AIL POSN XMTR-1 (DUAL) (22-13-03)
No
Chk ckt #2
EHV has internal open/short ckt
Replace A/P A hyd sys B (A/P B hyd sys A) EHV (27-11-21)
A/C wiring fault
Repair wiring
Servo has internal open/short ckt
Replace L inbd ail servo cont module (27-11-17)
On FCES cmptr:
• Chk pitch A/P servo 1 (2) FIM
Yel
Blk
Swap pitch cmpt No. 1 and No. 2
Fault follows pitch cmptr
Replace pitch cmptr-1 (-2) (22-11-01)
Fault remains
Install pitch cmptr in original positions
To Sheet 6
Chk ckt # 3
Hyd press. sol valve has internal open/short ckt
Replace A/P A hyd sys B (A/P B hyd sys A) press. sol valve (22-11-07)
APFDS engaged pnl has internal open/short ckt
Replace APFDS engage pnl (22-10-01)
Servo has internal open/short ckt
Replace A/P stab control servo (22-11-05)
A/C wiring fault
Repair wiring
Ckt # 3 chk OK
Replace A/P A hyd sys B (A/P B hyd sys A) EHV (22-11-08)
A To Sheet 6
M1-0005-22-1159

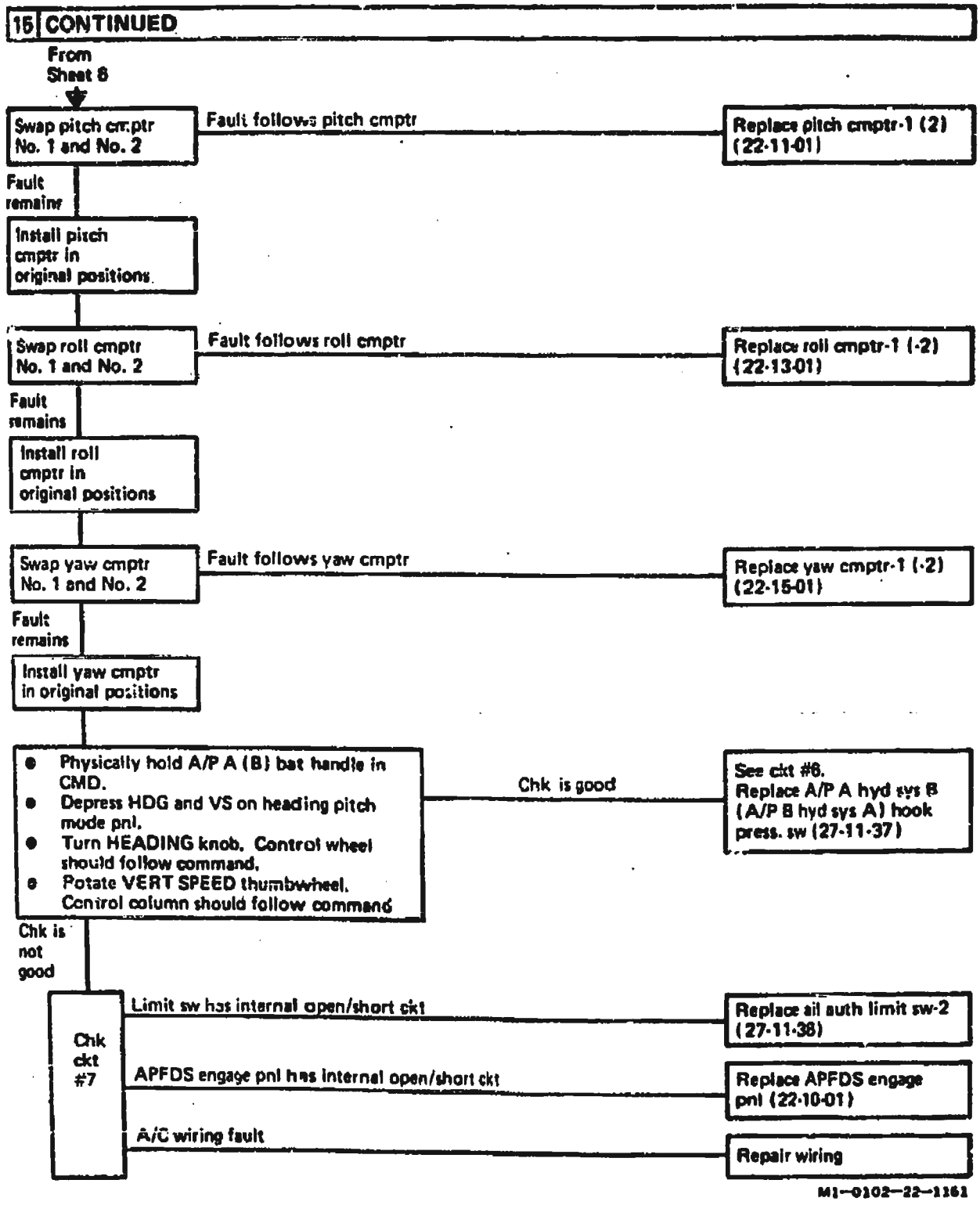
R R Autopilot Will Not Remain Engaged Faults
Figure 106 (Sheet 5)


15 CONTINUED
From Sheet 6
From Sheet 6
A
Chk ckt # 8
High auth hook press sw has internal short to press position
Replace A/P A (B) hyd sys B (A) high auth hook press sw (22-11-09)
High auth hook enp SOV frozen in open position
Replace A/P A (B) hyd sys B (A) high auth hook ong sol valve (22-11-07)
A/C wiring fault
Repair wiring
on FCES cmptr:
• Chk roll A/P servo 1 (2) FIM
Yes
Swap roll cmptr No. 1 and No. 2
Fault follows roll cmptr
Replace roll cmptr 1 (-2) (22-13-01)
Blk
Fault remains
Install roll cmptr in original positions
• Turn off all hydro except B for A/P A or A for A/P B.
• Turn A/P off.
• Turn control wheel
No movement of L inbd aileron
See ckt # 4.
• Replace hyd sys B (A) servo press. SOV (27-11-20)
L inbd aileron follows control wheel
Chk ckt # 5
A/P press. SOV has internal open/short ckt
Replace A/P A hyd sys B (A/P B hyd sys A) press. SOV (27-11-21)
APFDS engaged pnl has internal open/short ckt
Replace APFDS engage pnl (22-10-01)
Servo has internal open/short ckt
Replace L inbd ail servo cont module (27-11-17)
A/C wiring fault
Repair wiring
Ckt # 5 ckt OK
Replace A/P A hyd sys B (A/P B hyd sys A) EHV (27-11-21)
Does A/P disengage only during application of control wheel force?
Yes
Check control wheel connector 2711-P1 (P2). Ref. 22-00-00 Schem 8 or 9.
No
To Sheet 7
M1-0004-22-1160

R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 6)

EFFECTIVITY: ALL

001B

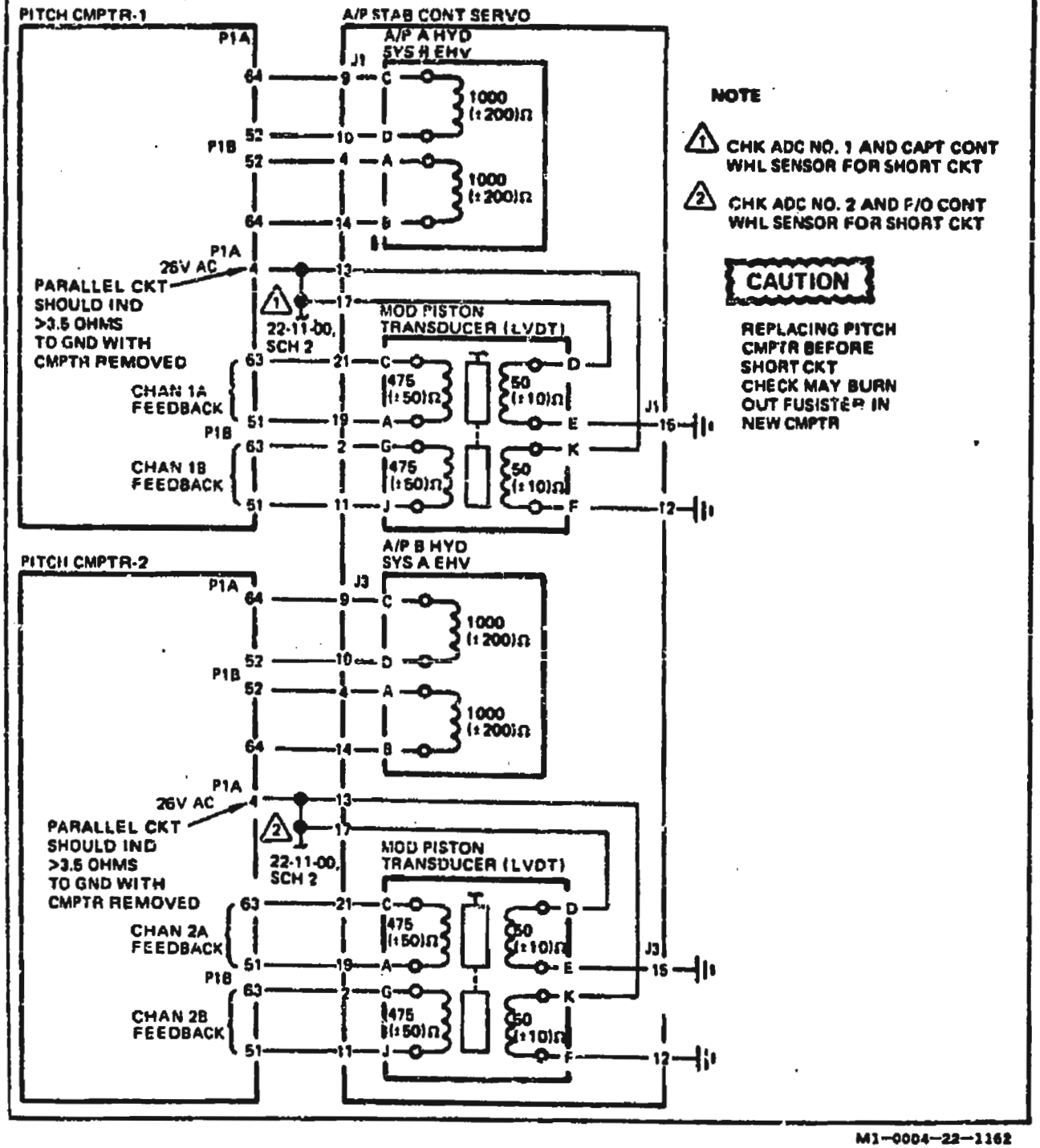

15 CONTINUED
From Sheet 6
Swap pitch cmptr No. 1 and No. 2
Fault follows pitch cmptr
Replace pitch cmptr-1 (2) (22-11-01)
Fault remains
Install pitch cmptr in original positions
Swap roll cmptr No. 1 and No. 2
Fault follows roll cmptr
Replace roll cmptr-1 (-2) (22-13-01)
Fault remains
Install roll cmptr in original positions
Swap yaw cmptr No. 1 and No. 2
Fault follows yaw cmptr
Replace yaw cmptr-1 (-2) (22-15-01)
Fault remains
Install yaw cmptr in original positions
• Physically hold A/P A (B) bat handle in CMD.
• Depress HDG and VS on heading pitch mode pnl.
• Turn HEADING knob. Control wheel should follow command.
• Potate VERT SPEED thumbwheel. Control column should follow command
Chk is good
See ckt #6. Replace A/P A hyd sys B (A/P B hyd sys A) hook press. sw (27-11-37)
Chk is not good
Chk ckt #7
Limit sw has internal open/short ckt
Replace ail auth limit sw-2 (27-11-38)
APFDS engage pnl has internal open/short ckt
Replace APFDS engage pnl (22-10-01)
A/C wiring fault
Repair wiring
M1-0102-22-1161

R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 7)

R EFFECTIVITY: ALL
R
001B

15 CONTINUED

CKT #1 PITCH CHAN EHV AND LVDT SIGNALS (REF. FIG. 107)


PITCH CMPTR-1
A/P STAB CONT SERVO
A/P A HYD SYS A EHV
P1A
P1B
J1
1000 (±200)Ω
26V AC
PARALLEL CKT SHOULD IND >3.5 OHMS TO GND WITH CMPTR REMOVED
22-11-00, SCH 2
MOD PISTON TRANSDUCER (LVDT)
475 (±50)Ω
50 (±10)Ω
CHAN 1A FEEDBACK
CHAN 1B FEEDBACK
PITCH CMPTR-2
A/P B HYD SYS A EHV
J3
CHAN 2A FEEDBACK
CHAN 2B FEEDBACK
NOTE
1 CHK ADC NO. 1 AND CAPT CONT WHL SENSOR FOR SHORT CKT
2 CHK ADC NO. 2 AND F/O CONT WHL SENSOR FOR SHORT CKT
CAUTION
REPLACING PITCH CMPTR BEFORE SHORT CKT CHECK MAY BURN OUT FUSISTER IN NEW CMPTR

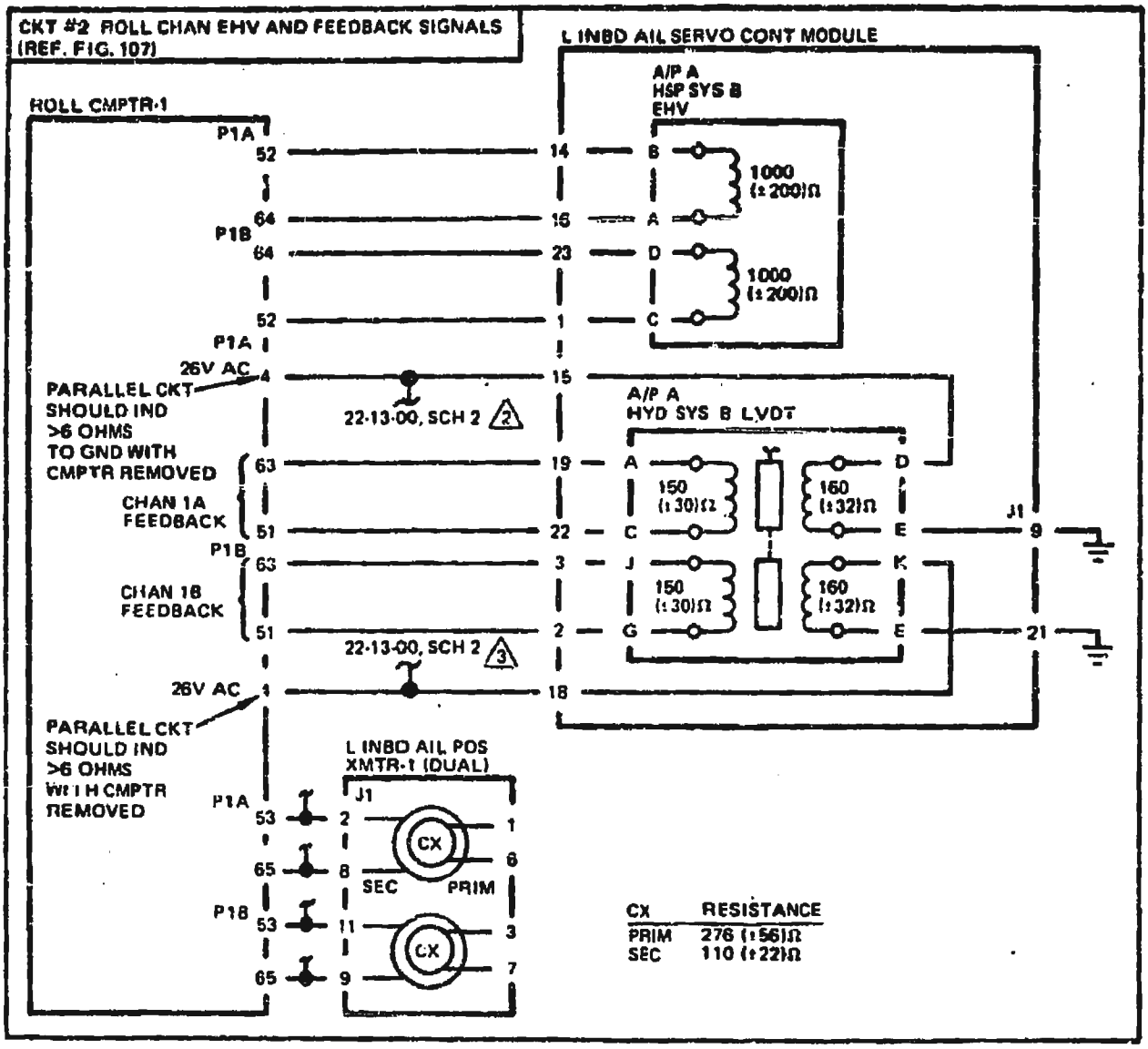
M1-0004-22-1162

R R Autopilot Will Not Remain Engaged Faults
Figure 106 (Sheet 8)

R R EFFECTIVITY: ALL

001B

15 CONTINUED



NOTE

1 CKT #2 CONTINUED ON NEXT PAGE.

2 CHECK COMPASS COUPLER NO. 1 AND CAPT CONT WHEEL FOR POSSIBLE SHORT CKT.

3 CHECK F/O CONT WHEEL FOR POSSIBLE SHORT CKT.

CAUTION

REPLACING A ROLL CMPTR BEFORE CHECKING FOR SHORT CKT MAY RESULT IN BURNING OUT A FUSISTER IN THE NEW CMPTR

M1-L 03-22-1163

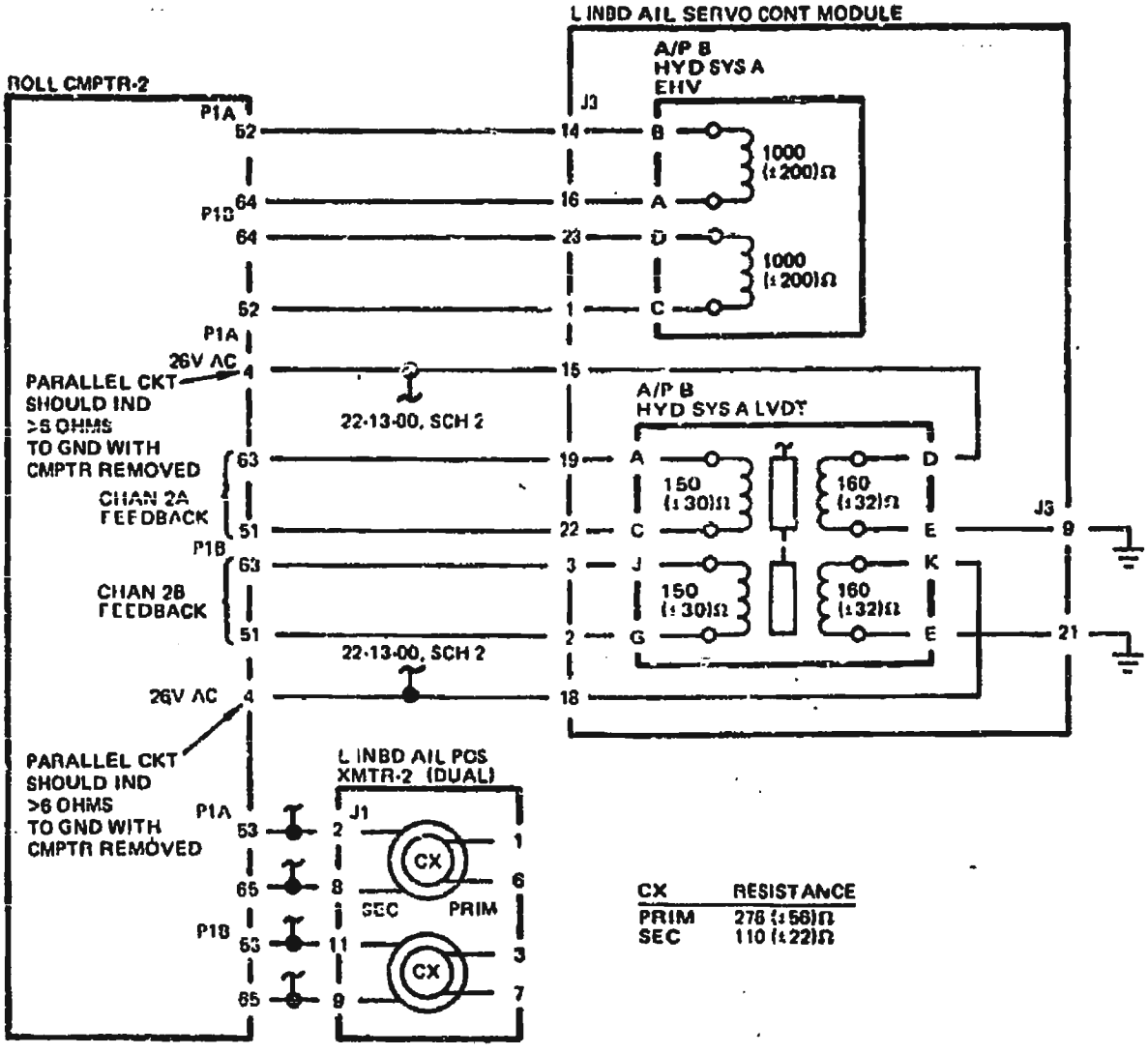
R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 9)

R EFFECTIVITY: ALL

R
001B

15 CONTINUED

CKT #2 ROLL CHAN EHV & FEEDBACK SIGNALS (REF. FIG. 105)



M1-0003-22-1219

R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 10)

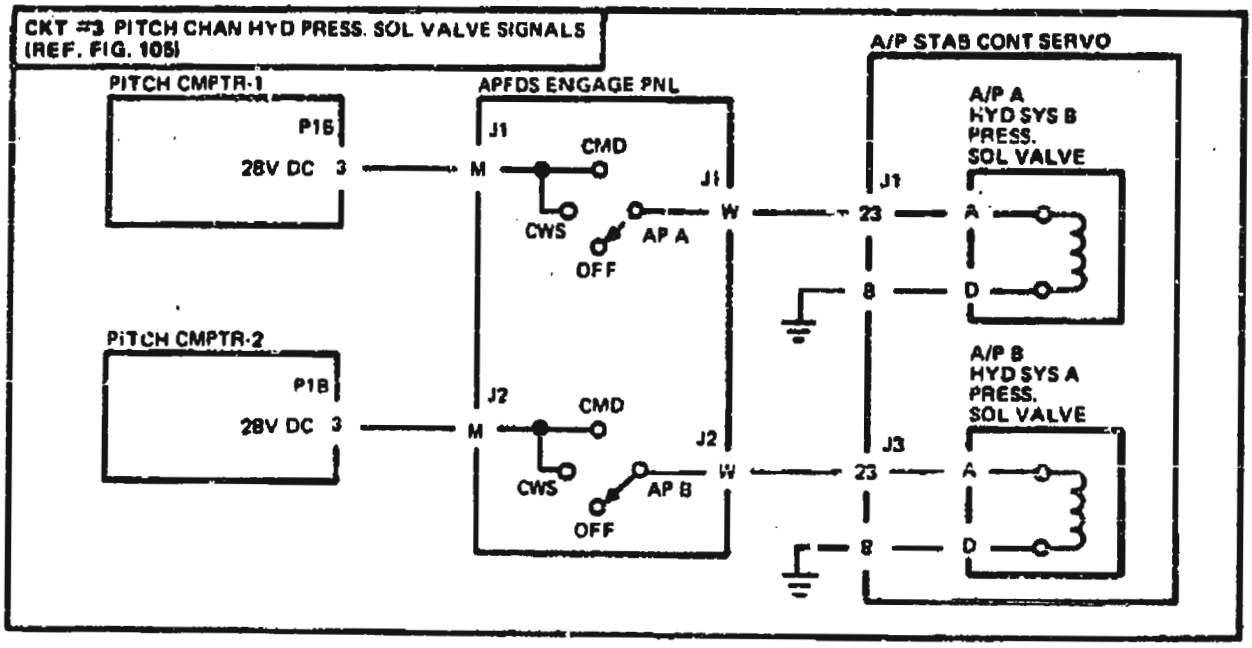
EFFECTIVITY: ALL

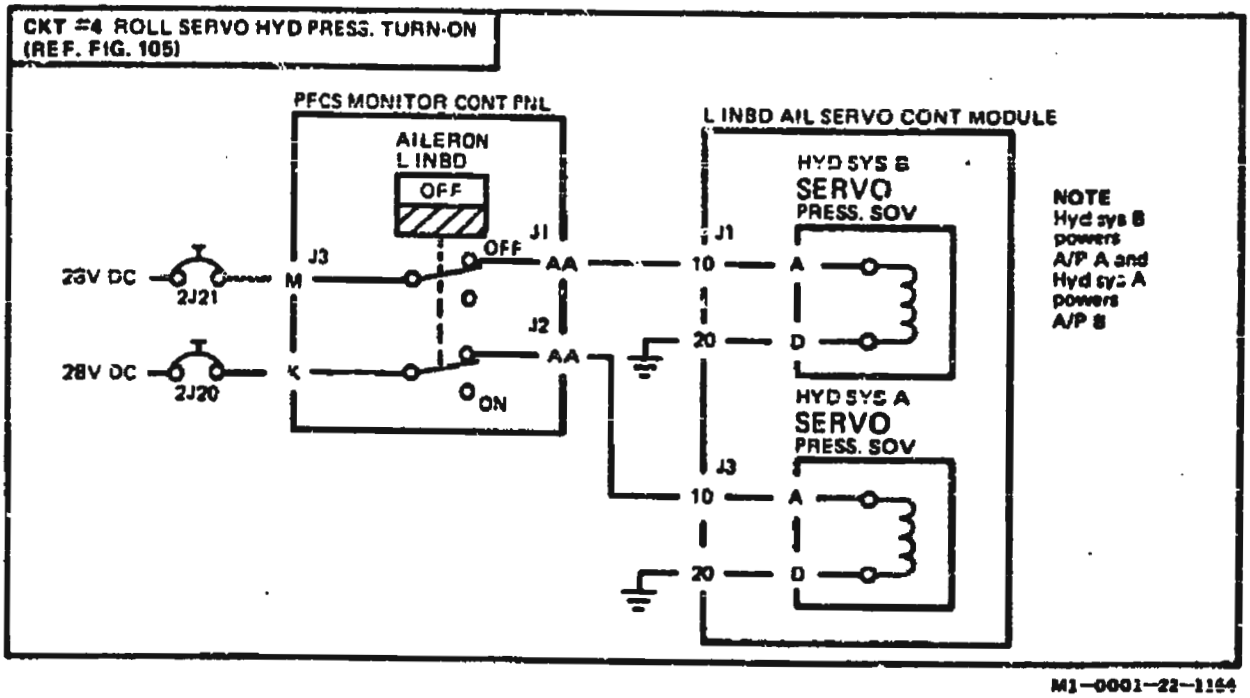
001B

15 CONTINUED

CAUTION

A SHORTED SOL VALVE CAN BURN OUT ITS ASSOCIATED PITCH CMPTR. SWAPPING CMPTR CAN RESULT IN TWO BAD CMPTR.

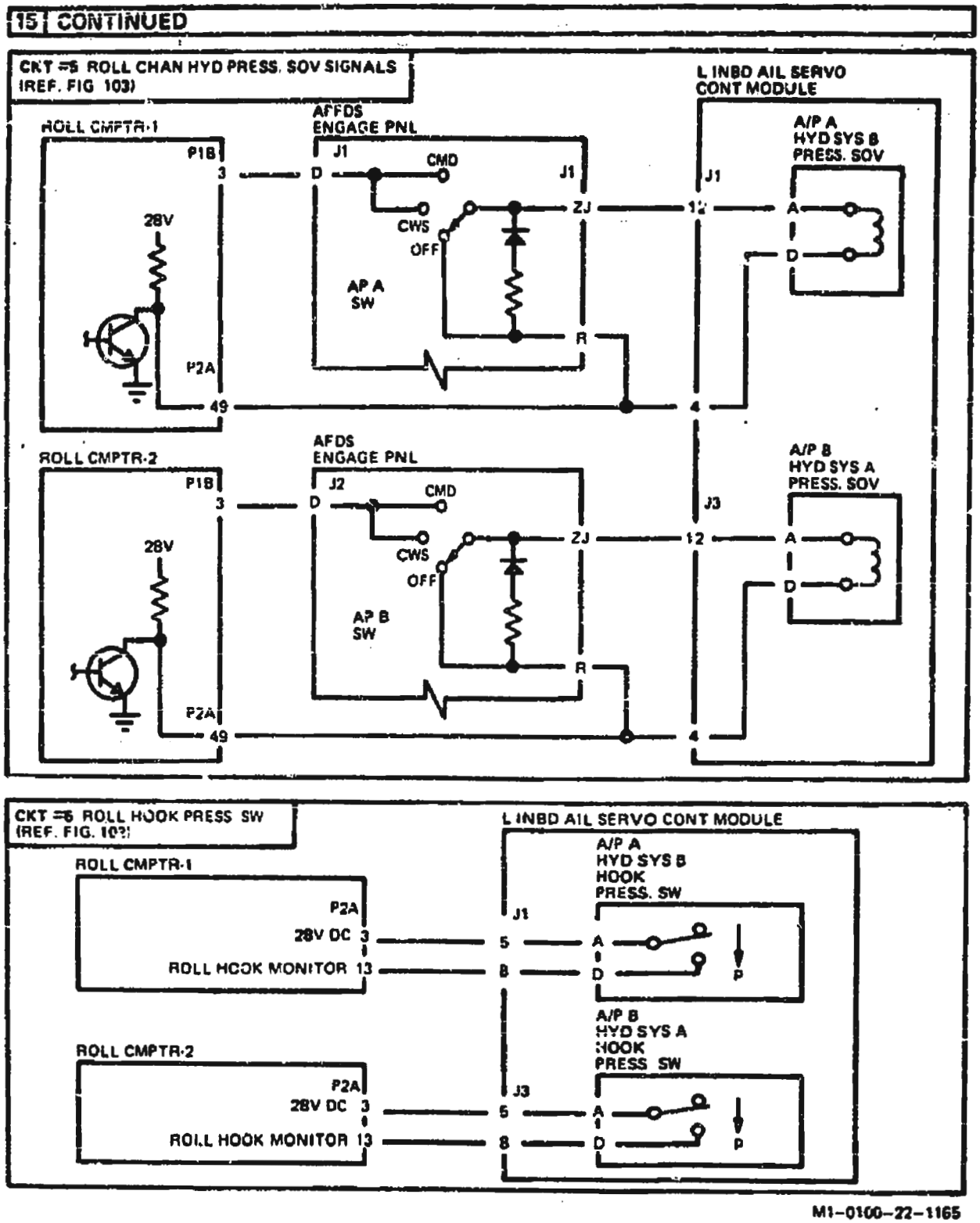




M1-0001-22-1154

R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 11)

15 CONTINUED

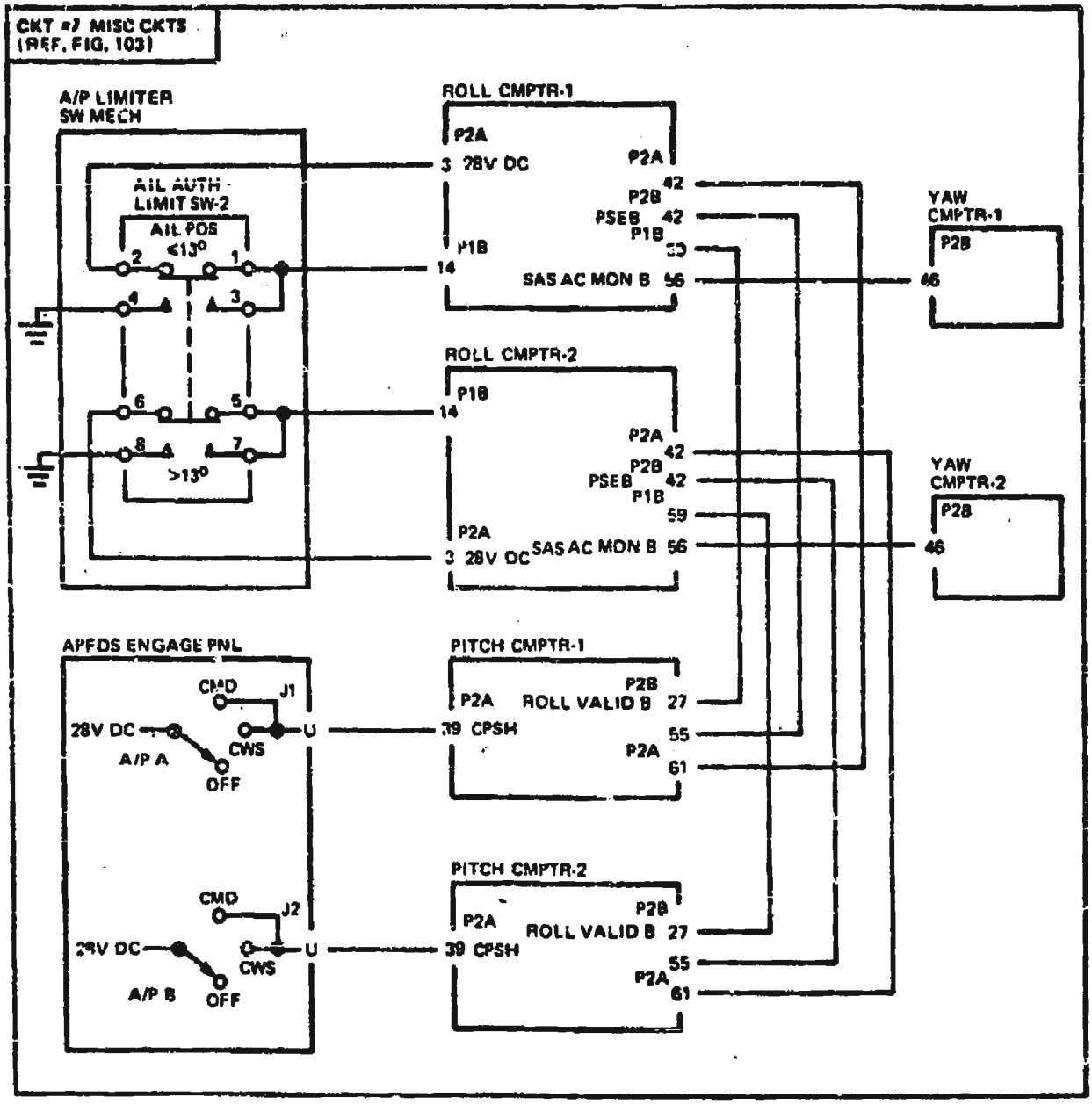


M1-0100-22-1165

R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 12)

R EFFECTIVITY: ALL
R
0018

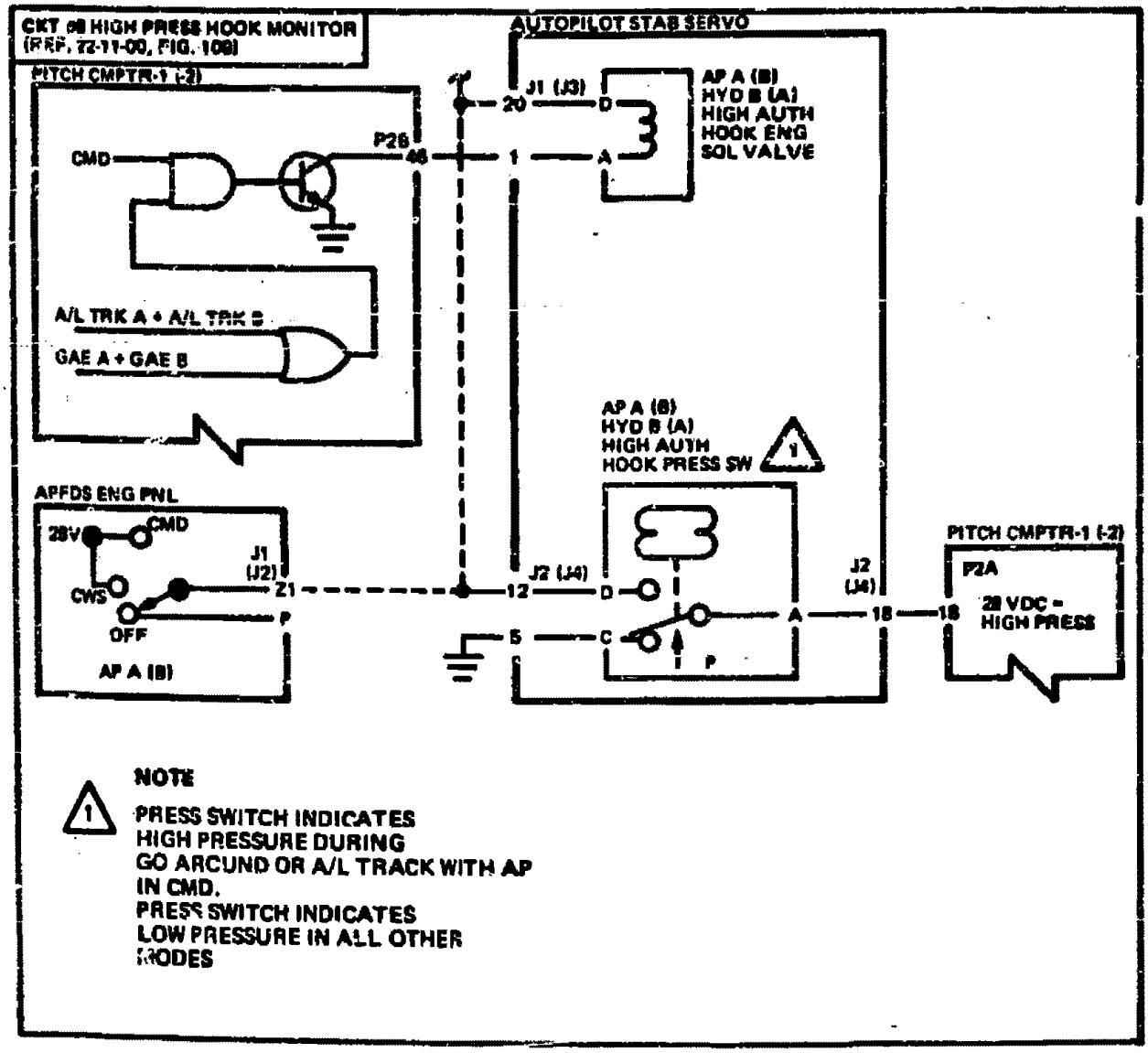
15 CONTINUED



M1-0100-22-1160

R Autopilot Will Not Remain Engaged Faults
R Figure 106 (Sheet 13)

R EFFECTIVITY: ALL
R
001B



M1-0100-22-1864

Autopilot Will Not Remain Engaged Faults
Figure 106 (Sheet 14)

EFFECTIVITY: ALL

0018

16	A/P LIMIT MESSAGE WITH AUTOPILOT A(B) ENGAGED IN CWS OR CMD. AUTOPILOT BAT HANDLE DROPS TO OFF ANY TIME AFTER ENGAGEMENT. (A PITCH INPUT COMMAND MAY BE REQUIRED TO DISC AUTOPILOT.) SYSTEM OPERATION IS NORMAL WHEN OTHER AUTOPILOT IS ENGAGED.

Shorted or open AP A (B) hyd sys B (A) press sol valve.

NOTE

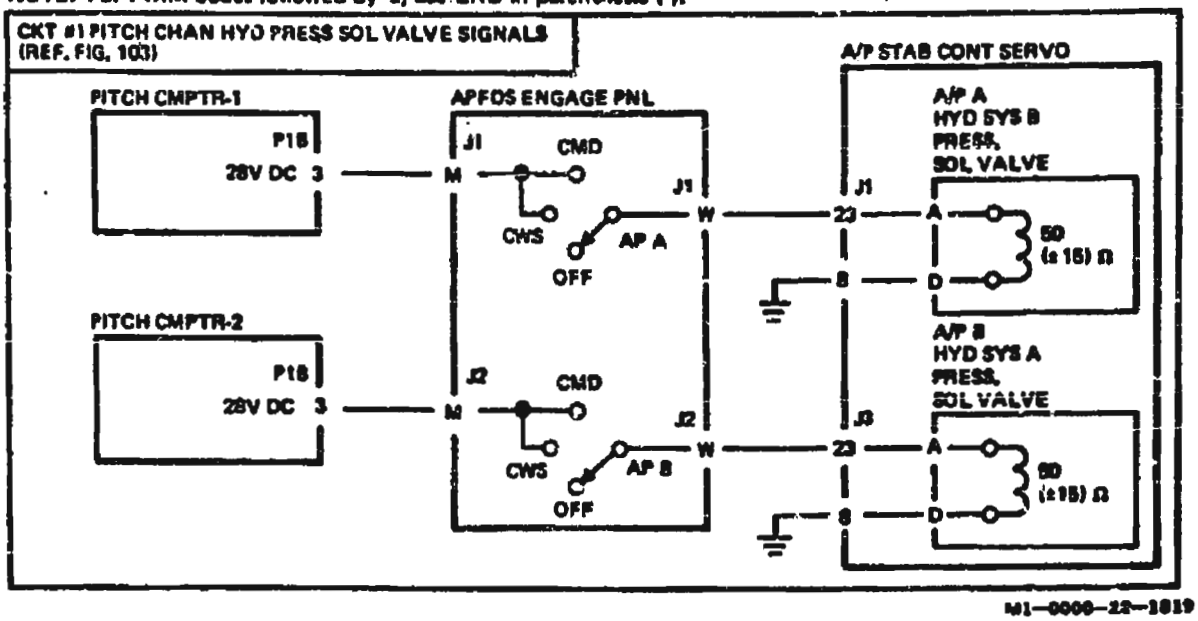
- It may be necessary to engage autopilot in VS modes, and rotate VS knob to duplicate fault.
- The PITCH A/P SERVO FIM may be set. (It requires an in-air condition to set on the ground.)

CAUTION

A shorted sol valve can burn out its associated pitch cmptr. Swapping cmptr can result in two bad cmptr.

Chk ckt #1	Hyd press. sol valve has internal open/short ckt	Replace A/P A hyd sys B (A/P B hyd sys A) press. sol valve (22-11-07). If sol valve was shorted, replace associated pitch cmptr (22-11-01)
	APFDS engaged pnl has internal open/short ckt	Replace APFDS engage pnl (22-10-01)
	Servo has internal open/short ckt	Replace A/P stab. control servo (22-11-05)
	A/C wiring fault	Repair wiring
	Ckt #1 chk OK	Replace pitch cmptr-1 (-2) (22-11-01)

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( ).

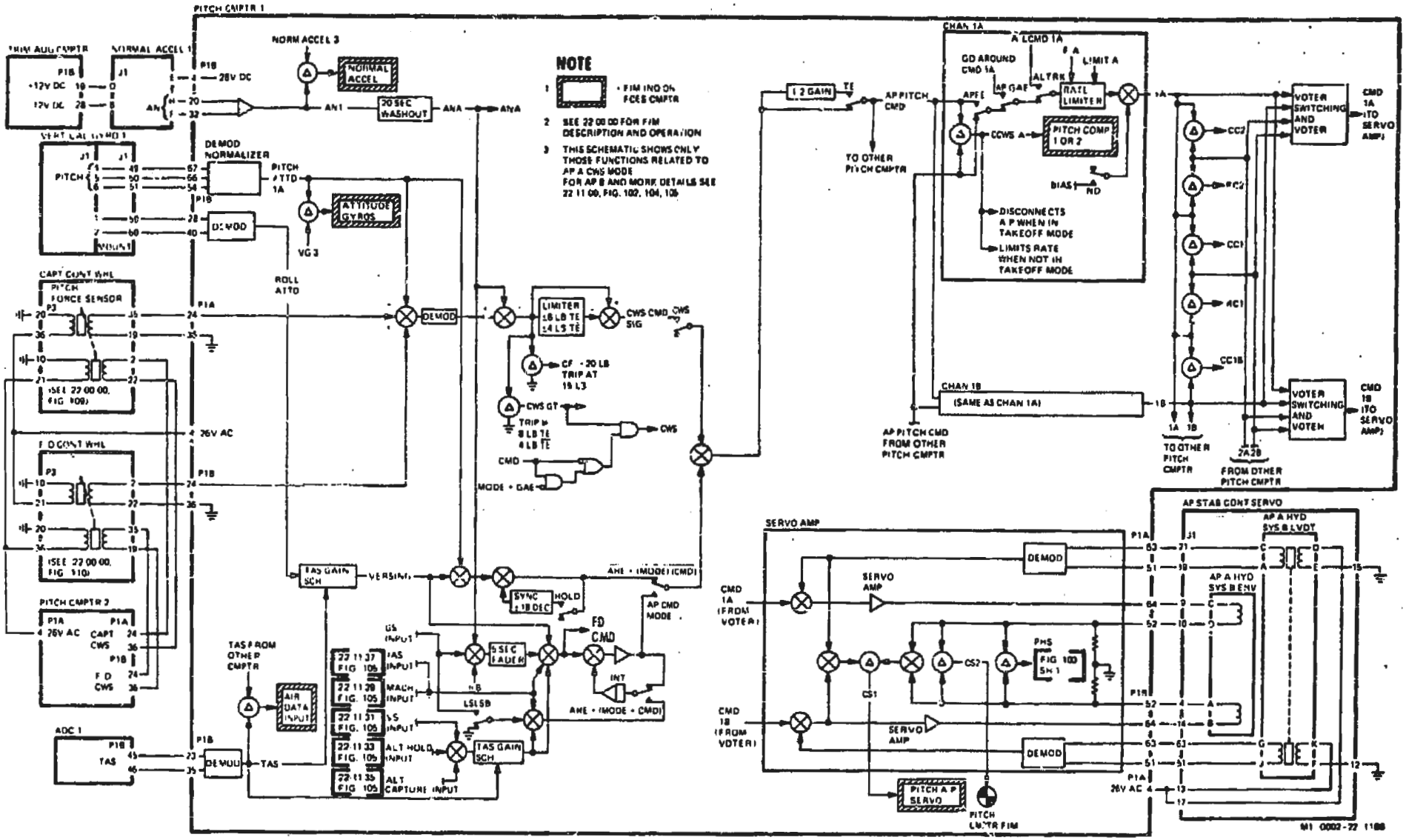


M1-0000-22-1819

R R Autopilot Will Not Remain Engaged Faults
Figure 106 (Sheet 15)

R R EFFECTIVITY: ALL

001B



R R Autopilot CWS Signal Flow Simplified Schematic
Figure 107

R R 001B EFFECTIVITY: ALL

21	CAPT (F/O) ADI ARTIFICIAL HORIZON SHOWS QUICK EXCURSIONS OF 3 – 5° IN PITCH OR ROLL. AUTOPILOT (SAME SIDE) FOLLOWS. OTHER ADI AND AUTOPILOT OPERATION IS NORMAL.

→ Replace VG-1 (-2) (34-21-04)

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( )

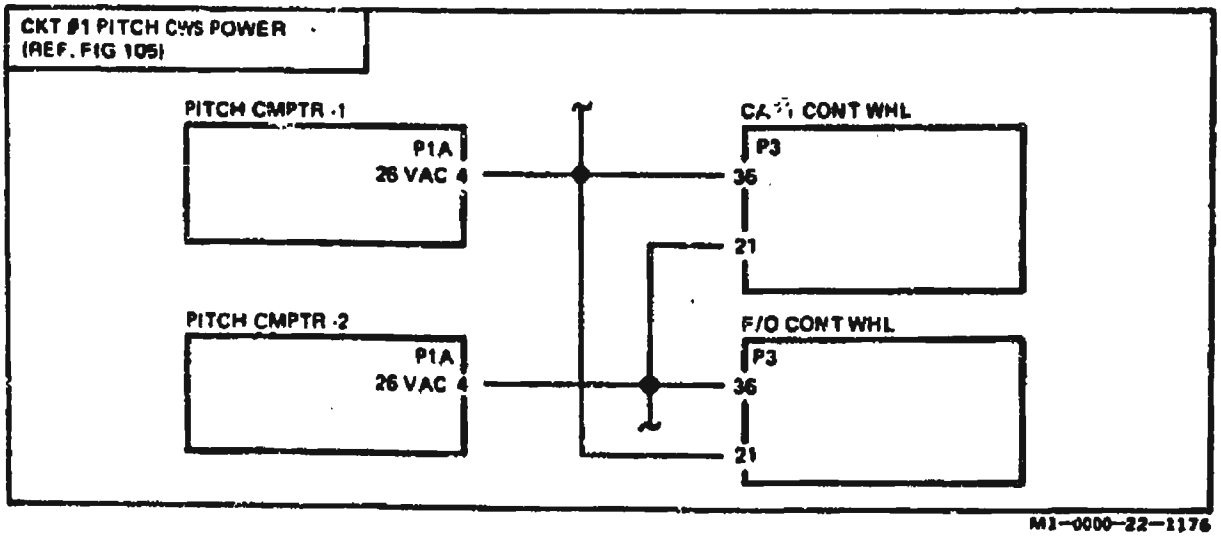
22	CAPT (F/O) HSI COMPASS CARD SHOWS QUICK EXCURSIONS OF 3 – 5° IN HEADING. AUTOPILOT (SAME SIDE) FOLLOWS. OTHER HSI AND AUTOPILOT OPERATION IS NORMAL.

→ Replace DG-1 (-2) (34-22-04)

23	NO CWS PITCH RESPONSE WITH EITHER CONTROL WHEEL, AP A(B) ENGAGED. OTHER AUTOPILOT OPERATION IS NORMAL.

Chk Ckt #1

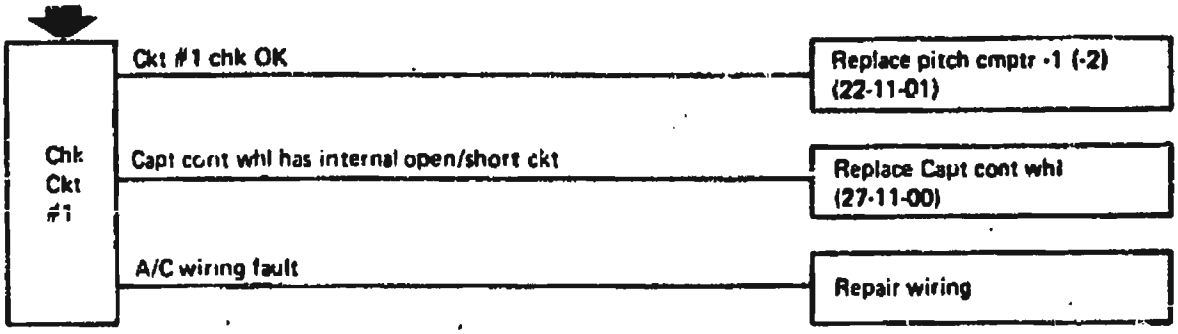
- Ckt #1 chk OK → Replace pitch cmptr -1 (-2) (22-11-01)
- A/C wiring fault → Repair wiring



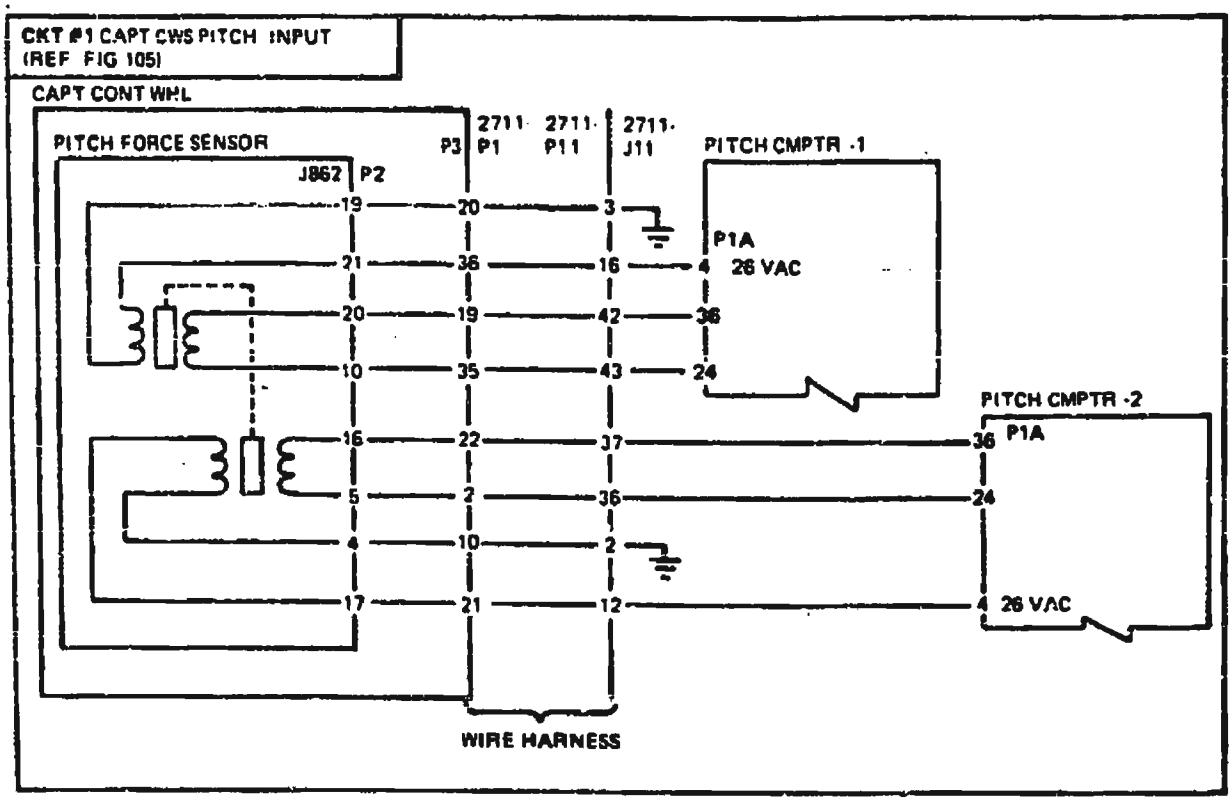
Autopilot "CWS" Cruise Mode Faults
Figure 108 (Sheet 1)

EFFECTIVITY: ALL

24	NO CWS PITCH RESPONSE WITH CAPT CONTROL WHEEL, AUTOPILOT A(B) ENGAGED. OTHER CONTROL WHEEL OPERATION IS NORMAL.

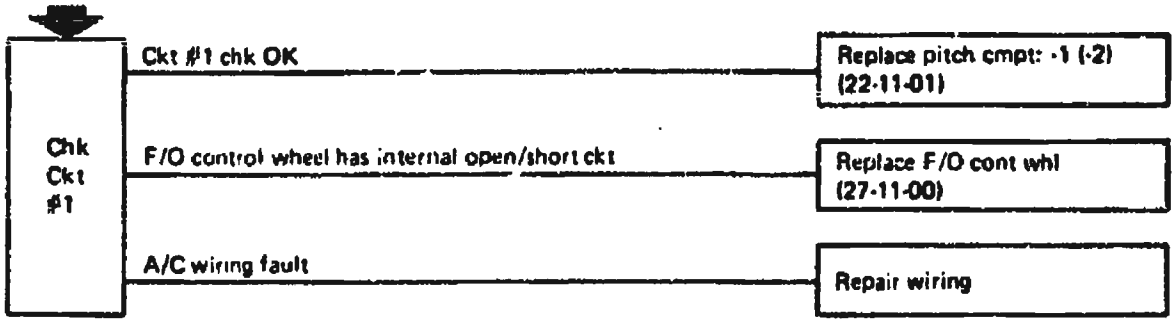

Chk Ckt #1
Ckt #1 chk OK
Replace pitch cmptr -1 (-2) (22-11-01)
Capt cont whl has internal open/short ckt
Replace Capt cont whl (27-11-00)
A/C wiring fault
Repair wiring

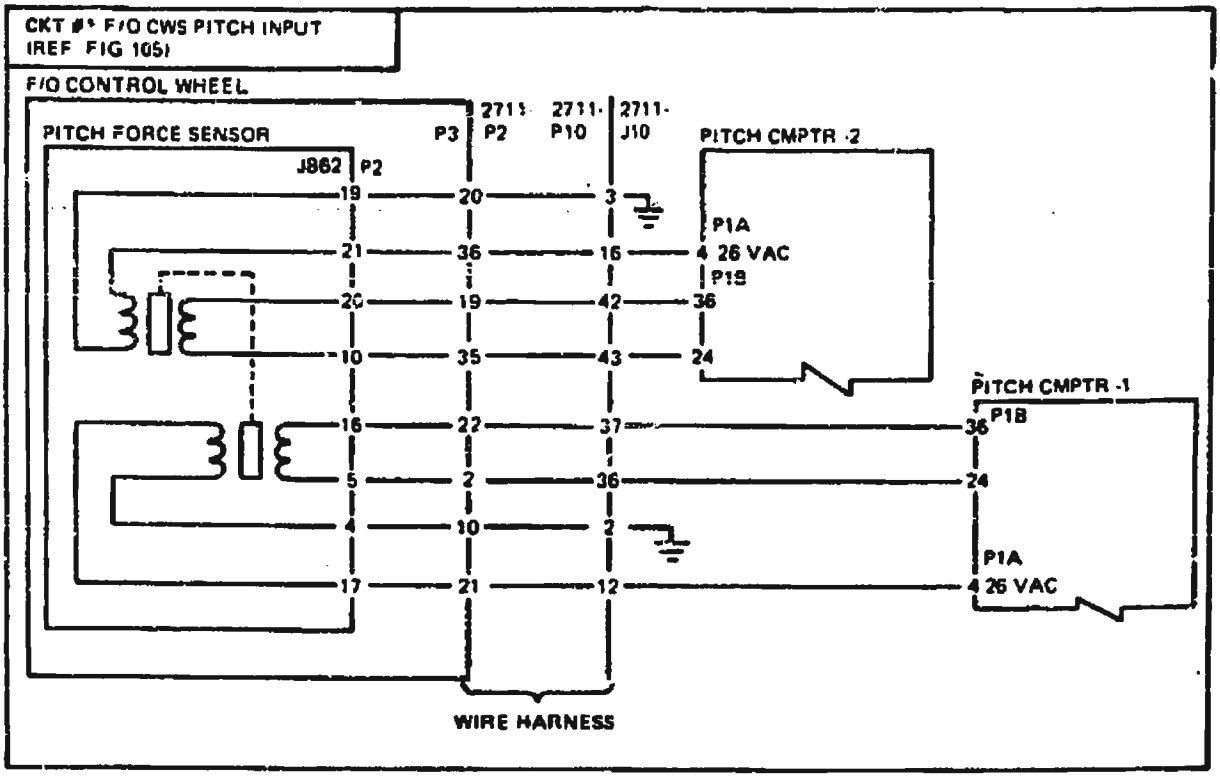
NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( ).



M1-0100-22-1180

25	NO CWS PITCH RESPONSE WITH F/O CONTROL WHEEL, AUTOPILOT A(B) ENGAGED. OTHER CONTROL WHEEL OPERATION IS NORMAL.


Chk Ckt #1
Ckt #1 chk OK
Replace pitch cmpt: -1 (-2) (22-11-01)
F/O control wheel has internal open/short ckt
Replace F/O cont whl (27-11-00)
A/C wiring fault
Repair wiring



M1-0100-22-1190

R R Autopilot "CWS" Cruise Mode Faults
Figure 108 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

26	NO CWS ROLL RESPONSE WITH EITHER CONTROL WHEEL, AUTOPILOT A(B) ENGAGED. OTHER AUTOPILOT OPERATION IS NORMAL.

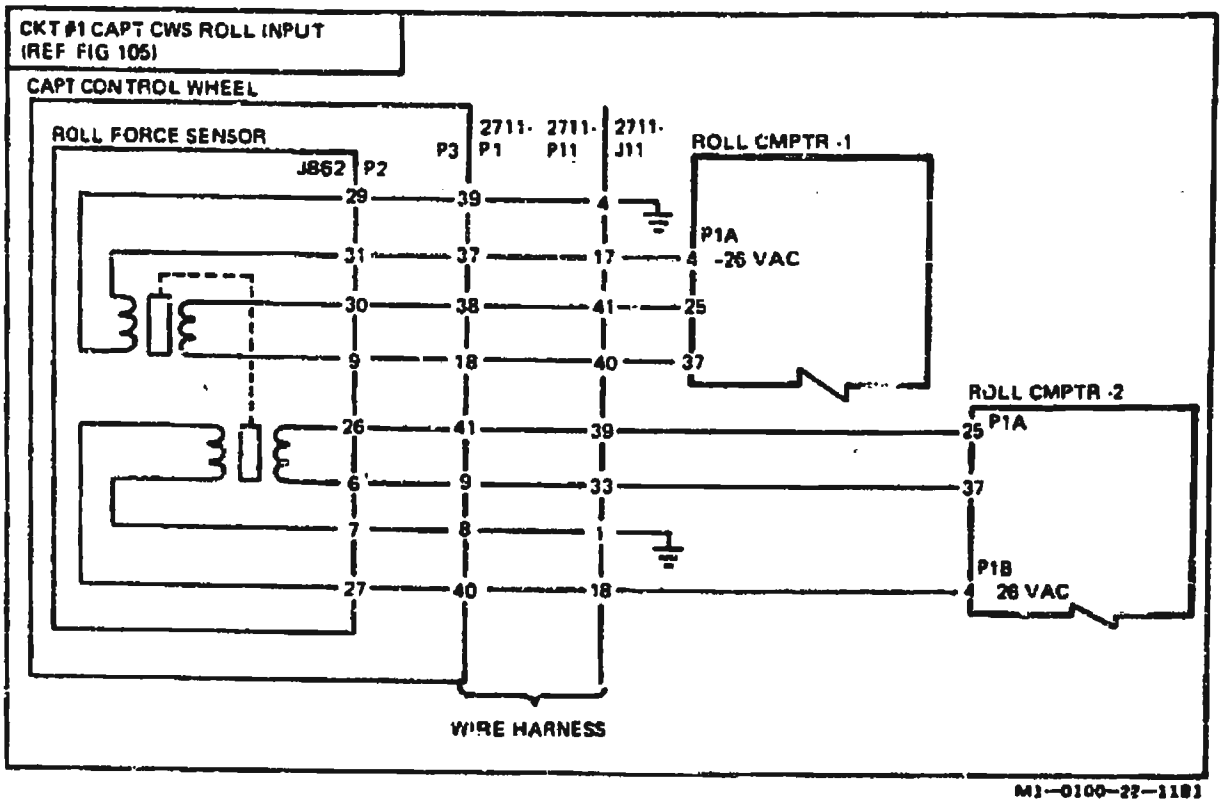
→ Replace roll cmptr -1 (-2) (22-13-01)

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( ).

27	NO CWS ROLL RESPONSE WITH CAPT CONTROL WHEEL, AUTOPILOT A(B) ENGAGED. OTHER CONTROL WHEEL OPERATION IS NORMAL.

Chk Ckt #1

- Ckt #1 chk OK → Replace roll cmptr -1 (-2) (22-13-01)
- Capt cont whl has internal open/short ckt → Replace Capt cont whl (27-11-00)
- A/C wiring fault → Repair wiring



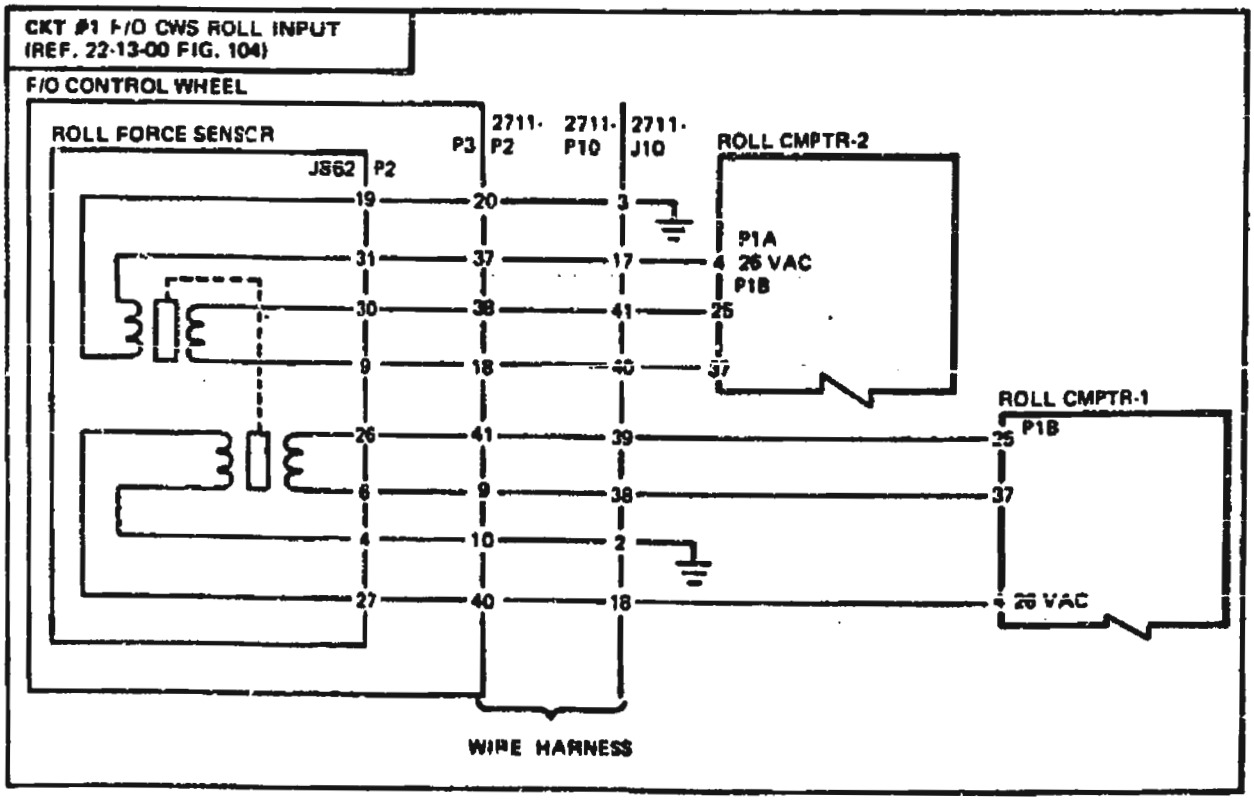
R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 4)

R EFFECTIVITY: ALL

28	NO CWS ROLL RESPONSE WITH F/O CONTROL WHEEL, AUTOPILOT A(B) ENGAGED. OTHER CONTROL WHEEL OPERATION IS NORMAL

Chk Ckt #1	Ckt #1 chk OK	Replace roll cmptr-1 (-2) (22-13-01)
	F/O control wheel has internal open/short ckt	Replace F/O cont whl (27-11-00)
	A/C wiring fault	Repair wiring

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( ).

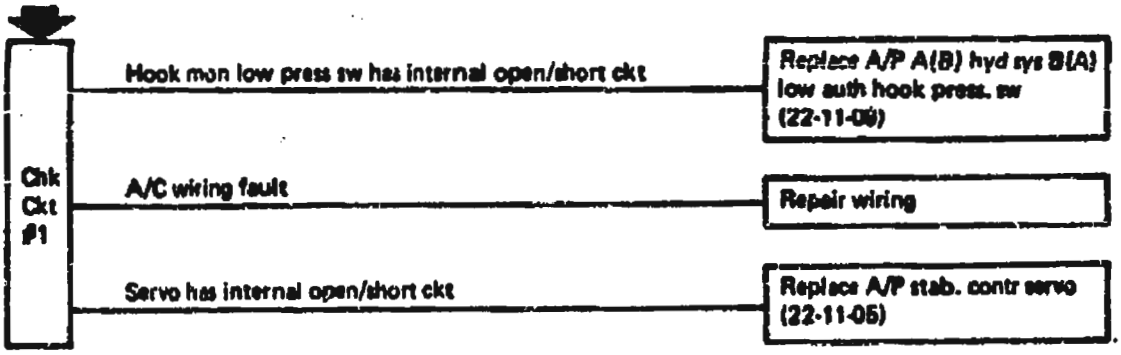


M1-0101-22-1102

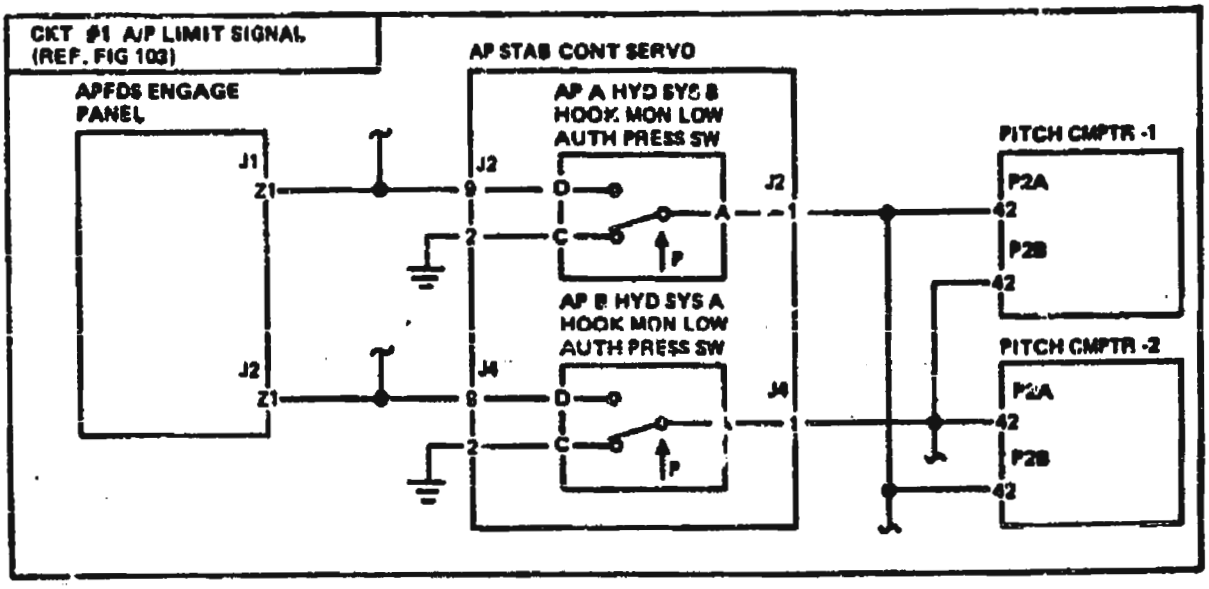
Autopilot "CWS" Cruise Mode Faults
Figure 108 (Sheet 5)

EFFECTIVITY: ALL

29	A/P LIMIT MESSAGE WITH AUTOPILOT A(B) ENGAGED. AUTOPILOT WILL FOLLOW VS PITCH INPUT COMMAND. A/P LIMIT MESSAGE IS OUT-OF-VIEW WHEN OTHER AUTOPILOT IS ENGAGED.


Chk Ckt #1
Hook mon low press sw has internal open/short ckt
Replace A/P A(B) hyd sys B(A) low auth hook press. sw (22-11-09)
A/C wiring fault
Repair wiring
Servo has internal open/short ckt
Replace A/P stab. contr servo (22-11-05)

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( ).



M1-0001-22-1183

R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 6)

R EFFECTIVITY: ALL
R
001B

30	**A/P LIMIT MESSAGE WITH AUTOPILOT A (B) ENGAGED. AUTOPILOT WILL NOT FOLLOW VS PITCH INPUT COMMAND. A/P LIMIT MESSAGE IS OUT-OF-VIEW WHEN OTHER AUTOPILOT IS ENGAGED.**

Shorted or open A/P A (B) hyd sys B (A) low auth eng sol valve.

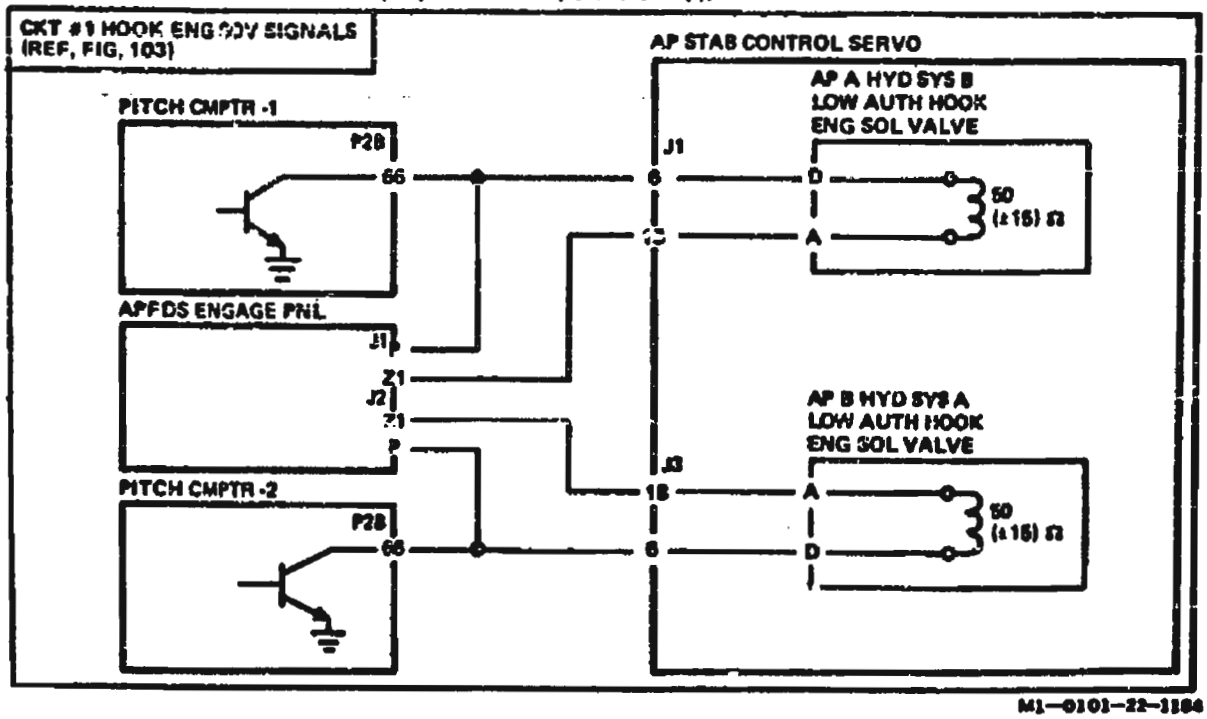
CAUTION

A shorted sol valve can burn out its associated pitch cmptr. Swapping cmptr can result in two bad cmptr.

Chk Ckt #1

- Hook eng sol valve has internal open/short ckt → Replace A/P A (B) hyd sys B(A) low auth eng sol valve (22-11-07)
- A/C wiring fault → Repair wiring
- Servo has internal open/short ckt → Replace A/P stab. cont servo (22-11-06)
- Ckt #1 chk OK → Replace pitch cmptr -1 (-2) (22-11-01)

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( ).



M1-0101-22-1186

Autopilot "CWS" Cruise Mode Faults
Figure 108 (Sheet 7)

EFFECTIVITY: ALL

31 A/P LIMIT MESSAGE WITH EITHER AUTOPILOT ENGAGED. BOTH AUTOPILOTS FOLLOW VS PITCH INPUT COMMAND.

- Remove both pitch cmptr
- Is A/P LIMIT message in-view?

No → Replace pitch cmptr -1 (-2) (22-11-01)

Yes

Install pitch cmptr

NOTE: For FIRM codes followed by -2, use LRU in parenthesis ( )

- Disconnect plug from Capt AFCS warning ind
- Is A/P LIMIT message in-view on F/O ind?

No → Replace Capt AFCS warning ind (22-10-06)

Connect plug to Capt AFCS warning ind

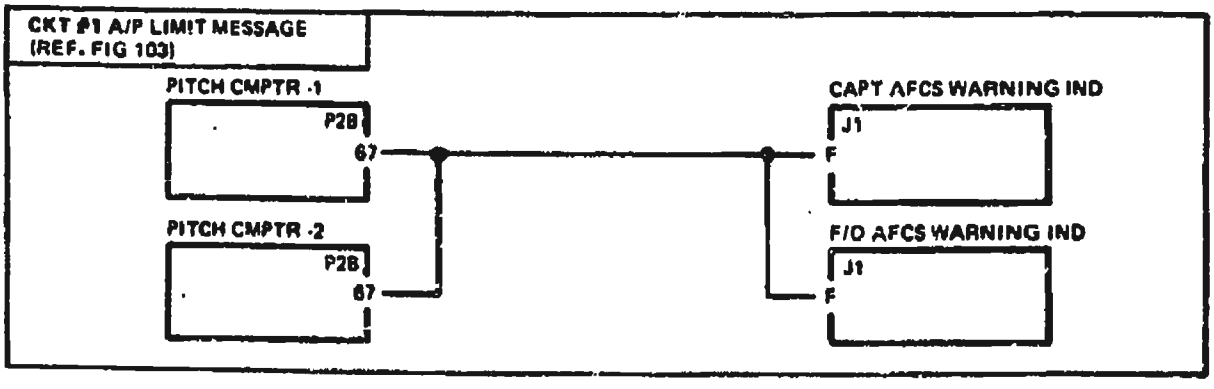
- Disconnect plug from F/O AFCS warning ind
- Is A/P LIMIT message in-view on Capt ind?

No → Replace F/O AFCS warning ind (22-10-06)

Yes

Chk Ckt #1

A/C wiring short to gnd → Repair wiring. Connect plug to F/O AFCS warning ind



M1-0100-22-1185

R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 8)

R EFFECTIVITY: ALL

R
R
001B

32 INCORRECT CWS PITCH RESPONSE WITH EITHER CONTROL WHEEL, AUTOPILOT A (B) ENGAGED. OTHER AUTOPILOT OPERATIONAL NORMAL. (EXAMPLE: IN CRUISE WITH A A/P ENGAGED IN CWS; IF A PITCH UP OR DOWN COMMAND IS INITIATED, A/P INITIALLY RESISTS THE CONTROL INPUT THEN RESPONDS PROPERLY. OTHER A/P OPERATION NORMAL.)

A "high" NULL on one pitch force transducer is suspect . . .

Can problem be duplicated on ground?

NO

YES

Swap pitch cmptr No. 1 and 2.

Fault moves to other systems → Replace original pitch cmptr-1(-2) (22-11-01)

Fault remains

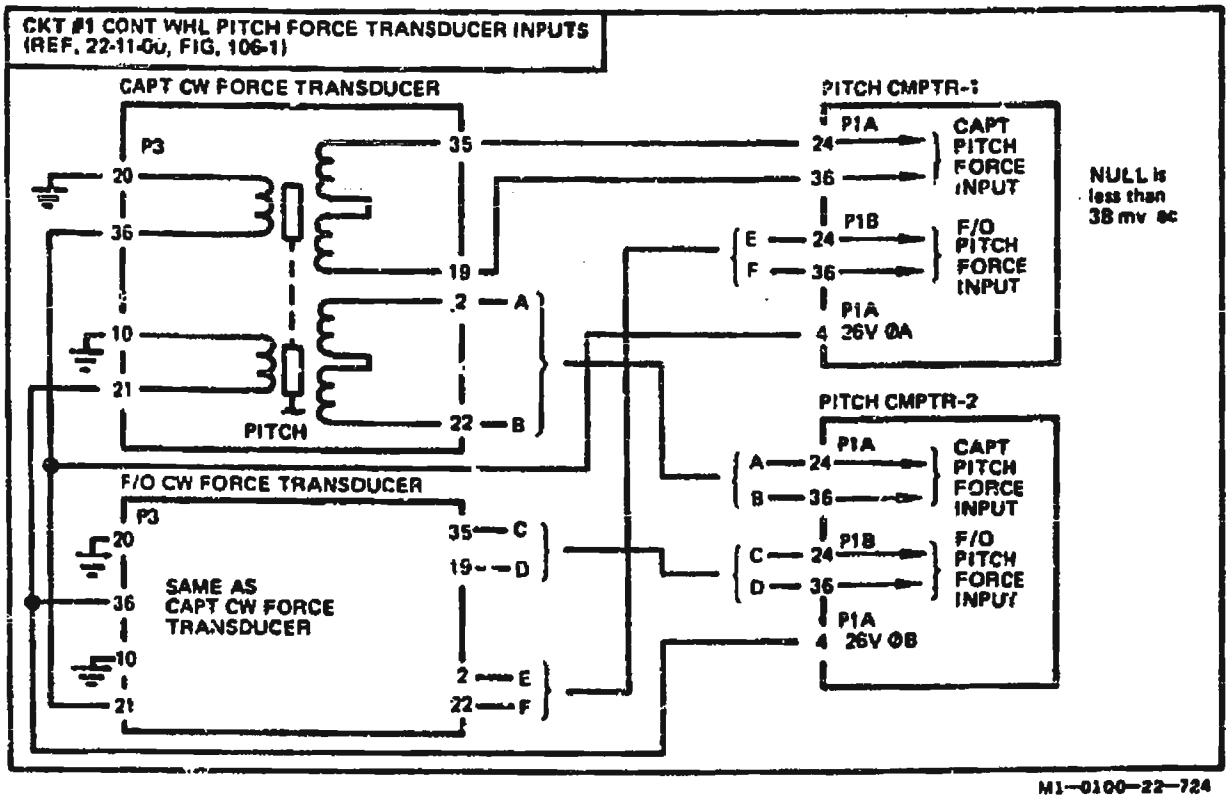
Connect Breakout Cable Assy (2 req) G/ITEL No. 22-00-20 or equiv. to pitch cmptr -1 (-2) (See 22-12-37, Fig. 509)

Capt cont whl NULL high → Replace Capt cont whl (27-11-00)

Chk Capt and F/O Pitch force inputs to pitch cmptr-1 (-2) for NULL per CK# 1

F/O cont whl NULL high → Replace F/O cont whl (27-11-00)

Cont whl NULLS OK → Replace pitch cmptr-1 (-2) (22-11-01)



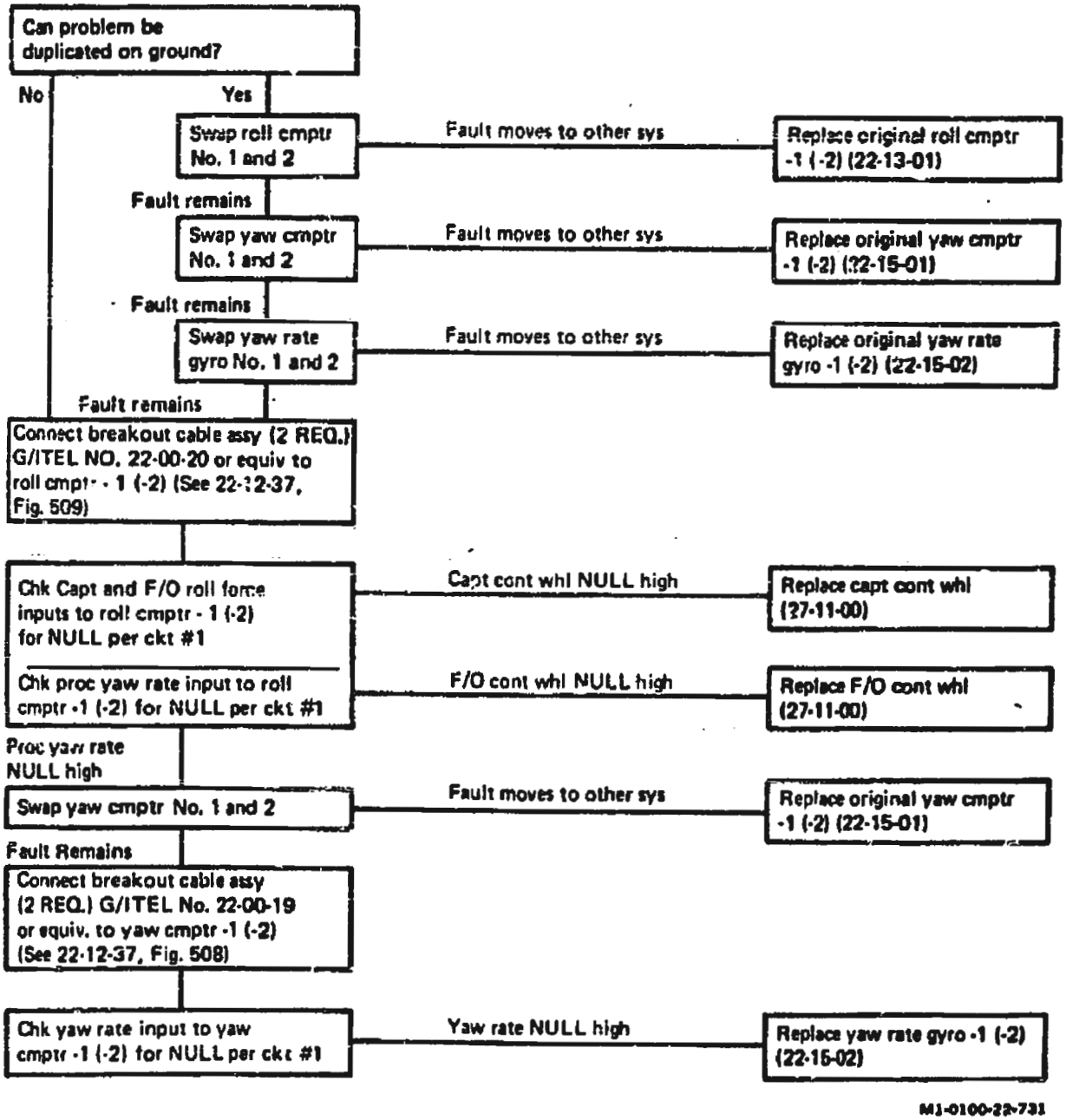
M1—0100—22—724

R R Autopilot "CWS" Cruise Mode Faults
Figure 108 (Sheet 9)

R R 001B EFFECTIVITY: ALL

33 INCORRECT CWS ROLL RESPONSE WITH EITHER CONTROL WHEEL, AUTOPILOT A (B) ENGAGED, OTHER AUTOPILOT OPERATIONS NORMAL. (EXAMPLE: IN CRUISE WITH A/P A ENGAGED IN CWS, IF A RIGHT TURN IS INITIATED, A/P INITIALLY RESISTS THE CONTROL INPUT AND ATTEMPTS TO TURN AIRCRAFT TO LEFT BEFORE RESPONDING PROPERLY. OTHER A/P OPERATION NORMAL)

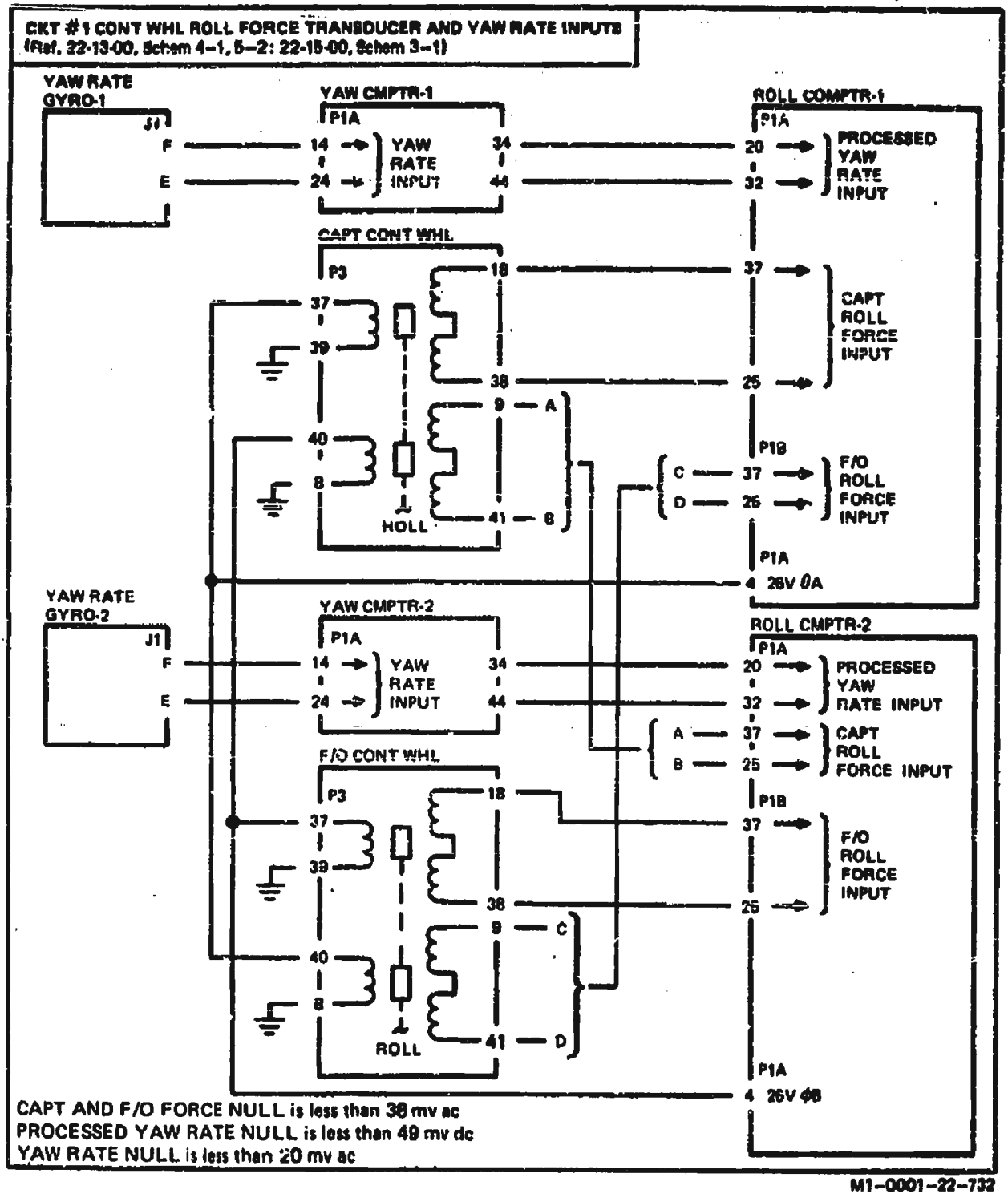
A "high" NULL on one roll force transducer or yaw rate gyro is suspect.


Can problem be duplicated on ground?
No
Yes
Swap roll cmptr No. 1 and 2
Fault moves to other sys
Replace original roll cmptr -1 (-2) (22-13-01)
Fault remains
Swap yaw cmptr No. 1 and 2
Fault moves to other sys
Replace original yaw cmptr -1 (-2) (22-15-01)
Fault remains
Swap yaw rate gyro No. 1 and 2
Fault moves to other sys
Replace original yaw rate gyro -1 (-2) (22-15-02)
Fault remains
Connect breakout cable assy (2 REQ.) G/ITEL NO. 22-00-20 or equiv to roll cmptr - 1 (-2) (See 22-12-37, Fig. 509)
Chk Capt and F/O roll force inputs to roll cmptr - 1 (-2) for NULL per ckt #1
Capt cont whl NULL high
Replace capt cont whl (27-11-00)
Chk proc yaw rate input to roll cmptr -1 (-2) for NULL per ckt #1
F/O cont whl NULL high
Replace F/O cont whl (27-11-00)
Proc yaw rate NULL high
Swap yaw cmptr No. 1 and 2
Fault moves to other sys
Replace original yaw cmptr -1 (-2) (22-15-01)
Fault Remains
Connect breakout cable assy (2 REQ.) G/ITEL No. 22-00-19 or equiv. to yaw cmptr -1 (-2) (See 22-12-37, Fig. 508)
Chk yaw rate input to yaw cmptr -1 (-2) for NULL per ckt #1
Yaw rate NULL high
Replace yaw rate gyro -1 (-2) (22-15-02)
M1-0100-22-731

R R Autopilot "CWS" Cruise Mode Faults
Figure 108 (Sheet 10)

R R 001B EFFECTIVITY: ALL

33 CONT



R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 11)

EFFECTIVITY: ALL

0018

34	AP A AND B TRIPS FROM CMD TO CWS WITH VERY LITTLE TURN PRESSURE ON CAPT (F/O) CONTROL WHEEL. OTHER CONTROL WHEEL OPERATION IS NORMAL.

→ Replace Capt (F/O) control wheel (27-11-00)

NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( ).

35	AP A (B) TRIPS FROM CMD TO CWS WITH VERY LITTLE TURN PRESSURE ON BOTH CONTROL WHEELS.

→ Replace roll cmptr -1 (-2) (22-13-01)

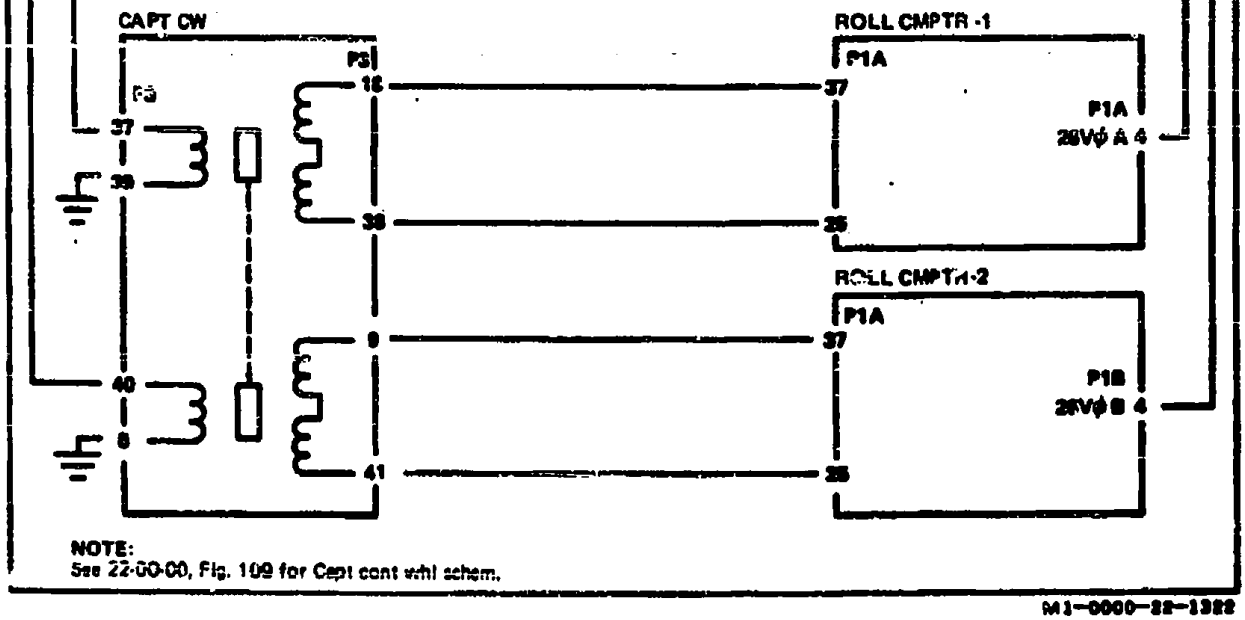
NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( ).

36	AP A (B) WILL NOT TRIP FROM CMD TO CWS WITH OVER 15 POUNDS OF TURN FORCE APPLIED TO CAPT CONTROL WHEEL. OTHER CONTROL WHEEL OPERATION IS NORMAL.

Chk wiring between Capt cont whl and roll cmptr -1 (-2) per Ckt # 1

- Capt cont whl has internal open/short ckt → Replace Capt control wheel (27-11-00)
- A/C wiring fault → Repair wiring

CKT #1 CAPT CWS ROLL FORCE SENSOR CKT (REF 22-15-00, 104-1)



NOTE:
See 22-00-00, Fig. 109 for Capt cont whl schem.

M1-0000-22-1322

R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 12)

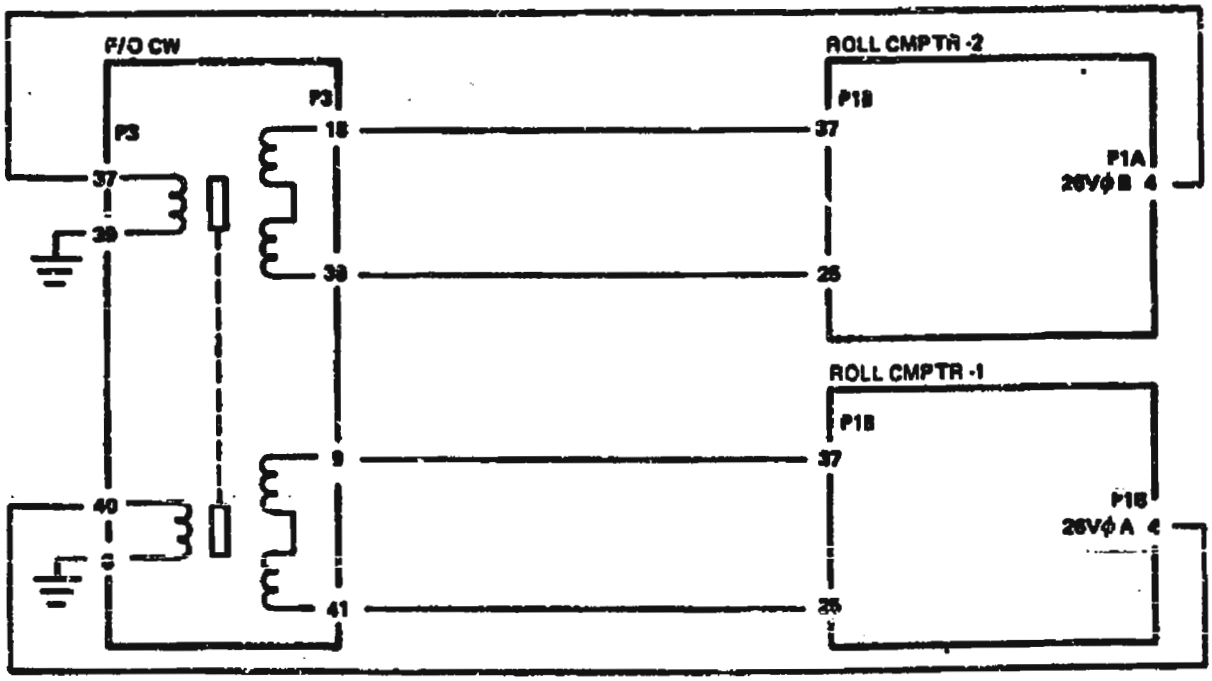
R EFFECTIVITY: ALL
R
001B

37 AP A (B) WILL NOT TRIP FROM CMD TO CWS WITH OVER 15 POUNDS OF TURN FORCE APPLIED TO F/O CONTROL WHEEL. OTHER CONTROL WHEEL OPERATION NORMAL.

Chk wiring between F/O cont whl and roll cmptr -1 (-2) per Ckt #1

- F/O cont whl has internal open/short ckt → Replace F/O control wheel (27-11-00)
- A/C wiring fault → Repair wiring

CKT #1 F/O CWS ROLL FORCE SENSOR CKT (REF. 22-13-00, 104-1)



NOTE

See 22-00-00, Fig. 110 for F/O cont whl schem.

38 AP A (B) WILL NOT TRIP FROM CMD TO CWS WITH OVER 15 POUNDS OF TURN FORCE APPLIED TO BOTH CONTROL WHEELS.

- Replace roll cmptr -1 (-2) (22-13-01)

NOTE

For FIRM codes followed by -2, use LRU is parenthesis ( ).

M1-0000-22-1329

R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 13)

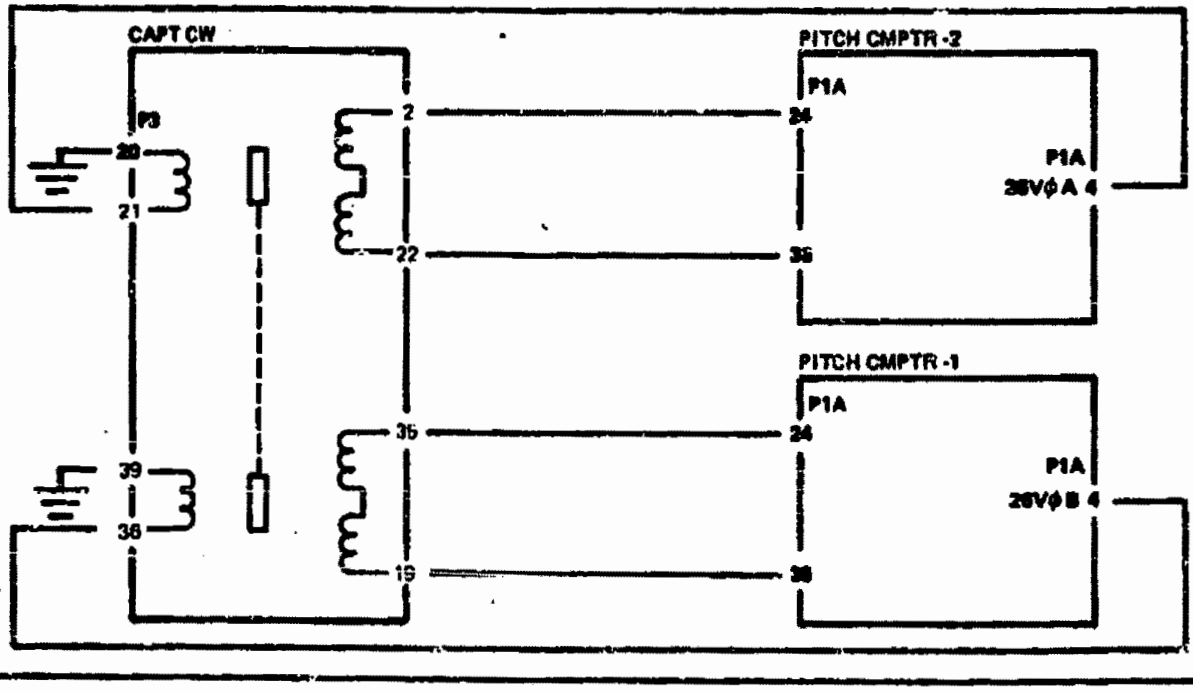
R EFFECTIVITY: ALL
R
001B

39 AP A AND B PITCH MODE (VS, ACT, IAS, MACH) WILL NOT RELEASE WITH 15 POUNDS OF PITCH FORCE APPLIED TO CAPT CONTROL WHEEL. OTHER CONTROL WHEEL OPERATION IS NORMAL.

Chk wiring between Capt cont whl and pitch cmptr -1 (-2) per Ckt # 1

- Capt cont roll has internal open/short ckt → Replace Capt control wheel (27-11-00)
- A/C wiring fault → Repair wiring

CKT # 1 CAPT CWS PITCH FORCE SENSOR CKT (REF 22-11-00, FIG. 105 AND 106)



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CR
CR

Autopilot "CWS" Cruise Mode Faults
Figure 108 (Sheet 14)

EFFECTIVITY: ALL

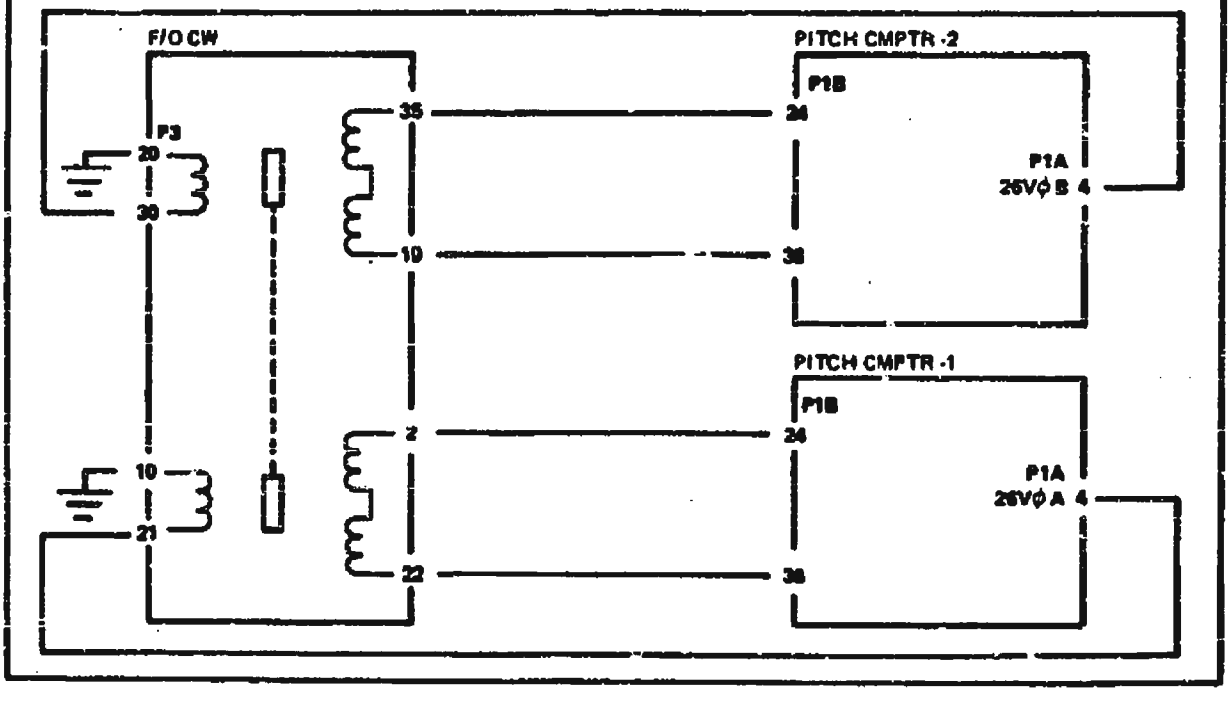
001B

40 AP A AND B PITCH MODE (VS, ALT, IAS, MACH) WILL NOT RELEASE WITH 15 POUNDS OF PITCH FORCE APPLIED TO F/O CONTROL WHEEL. OTHER CONTROL WHEEL OPERATION IS NORMAL.

Chk wiring between F/O control wheel and pitch cmptr -1 (-2) per Ckt # 1

- F/O cont whl has internal oper/short ckt → Replace F/O control wheel (27-11-00).
- A/C wiring fault → Repair wiring

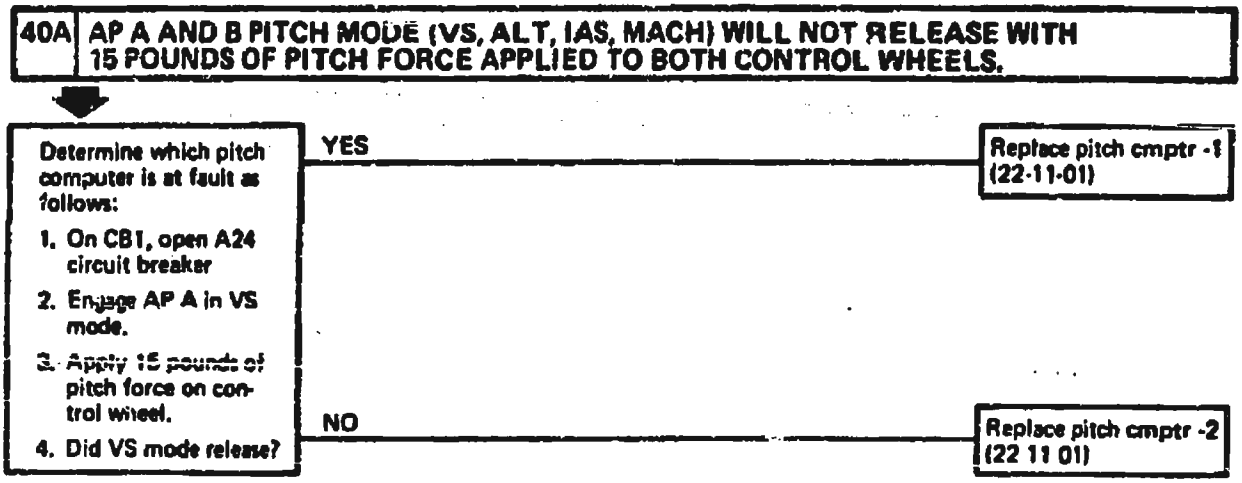
CKT #1 F/O CWS PITCH FORCE SENSOR CKT (REF 22-11-00, FIG. 105 AND 106)



M1-0000-22-1325

R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 15)

R EFFECTIVITY: ALL
R
001B


40A
AP A AND B PITCH MODE (VS, ALT, IAS, MACH) WILL NOT RELEASE WITH 15 POUNDS OF PITCH FORCE APPLIED TO BOTH CONTROL WHEELS.
Determine which pitch computer is at fault as follows:
1. On CB1, open A24 circuit breaker
2. Engage AP A in VS mode.
3. Apply 15 pounds of pitch force on control wheel.
4. Did VS mode release?
YES
Replace pitch cmptr -1 (22-11-01)
NO
Replace pitch cmptr -2 (22 11 01)

M1-0000-22-1326

R Autopilot "CWS" Cruise Mode Faults
R Figure 108 (Sheet 16)

R EFFECTIVITY: ALL
R
001B

41 AIRCRAFT PORPOISES WHEN AUTOPILOT A (B) IS ENGAGED IN PITCH CMD MODE (ALT, VS OR IAS HOLD). NO OTHER COCKPIT INDICATIONS

Possible "NORM ACCEL" FIM on FCES cmptr → Replace normal accel. (22-11-02)

42 AIRCRAFT PORPOISES WHEN AUTOPILOT A (B) IS ENGAGED IN PITCH CMD MODE (ALT, VS OR IAS HOLD). CADC INSTRUMENTS (SAME SIDE) ARE ERRATIC OR DO NOT AGREE WITH OTHER SIDE WHEN AP IS OFF.

Possible "AIR DATA INPUT" FIM on FCES cmptr → Replace ADC-1 (-2). (34-14-01)

43 AIRCRAFT PORPOISES WHEN AUTOPILOT A (B) IS ENGAGED. NO PITCH CMD MODES ENGAGED

Replace pitch cmptr -1 (-2) (22-11-01) →
- Bleed hyd sys 3 (A).
- If problem persists, check VG (INU) same side

44 AIRCRAFT PORPOISES WHEN AUTOPILOT A (B) IS ENGAGED. NO PITCH CMD MODES ENGAGED. ADI ARTIFICIAL HORIZON (SAME SIDE) MAY SHOW EXCURSIONS OF 3 - 5° IN PITCH AND ROLL

→ Replace VG-1 (-2) (34-21-04)

45 AIRCRAFT PORPOISES WHEN EITHER AUTOPILOT IS ENGAGED. OK WHEN ONE PITCH TRIM SYSTEM IS TURNED OFF. (CONTROL COLUMN MOVES APPROXIMATELY 1 INCH IN 2 - 3 SECONDS.)

- Chk pitch cmptr-1 (-2) for incorporation of Collins SB 30 and 37.
- Are SB incorporated?

NO → Replace pitch cmptr-1(-2) (22-11-01)

YES

- Chk aft pitch coupler actuator rigging (Ref. 27-41-13, Para. 3B, Step 10)
- Chk autopilot servo rigging (Ref. 22-11-05, Para. 3B, Steps 11 and 12).
- Also check for looseness in control rods between mechanical pitch trim and feel assy, and AP servo

OK → Perform following rigging in 27-41-00, 501:

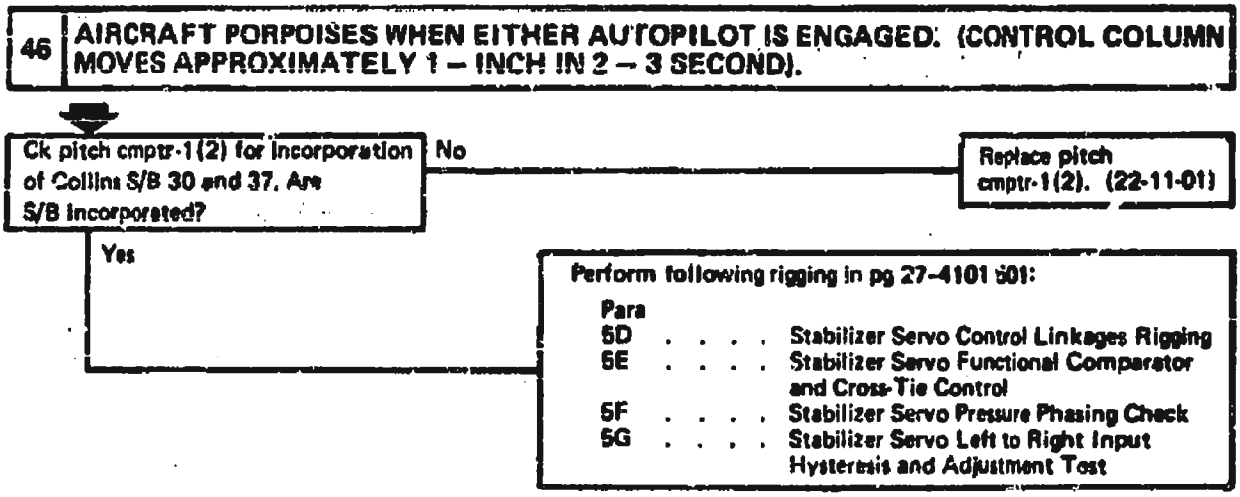
Para	
5D	Stabilizer Servo Control Linkages Rigging
5E	Stabilizer Servo Functional Comparator and Cross-Tie Control
5F	Stabilizer Servo Pressure Phasing Check
5G	Stabilizer Servo Left to Right Input Hysteresis and Adjustment Test

NOT OK → RIG per 27-41-13 or 22-11-05

M1-0102-22-1210

R R Autopilot Porpoising Faults
Figure 109 (Sheet 1)

EFFECTIVITY: ALL


46
AIRCRAFT PORPOISES WHEN EITHER AUTOPILOT IS ENGAGED. (CONTROL COLUMN MOVES APPROXIMATELY 1 – INCH IN 2 – 3 SECOND).
Ck pitch cmptr-1(2) for incorporation of Collins S/B 30 and 37. Are S/B incorporated?
No
Replace pitch cmptr-1(2). (22-11-01)
Yes
Perform following rigging in pg 27-4101 501:
Para
5D . . . . Stabilizer Servo Control Linkages Rigging
5E . . . . Stabilizer Servo Functional Comparator and Cross-Tie Control
5F . . . . Stabilizer Servo Pressure Phasing Check
5G . . . . Stabilizer Servo Left to Right Input Hysteresis and Adjustment Test

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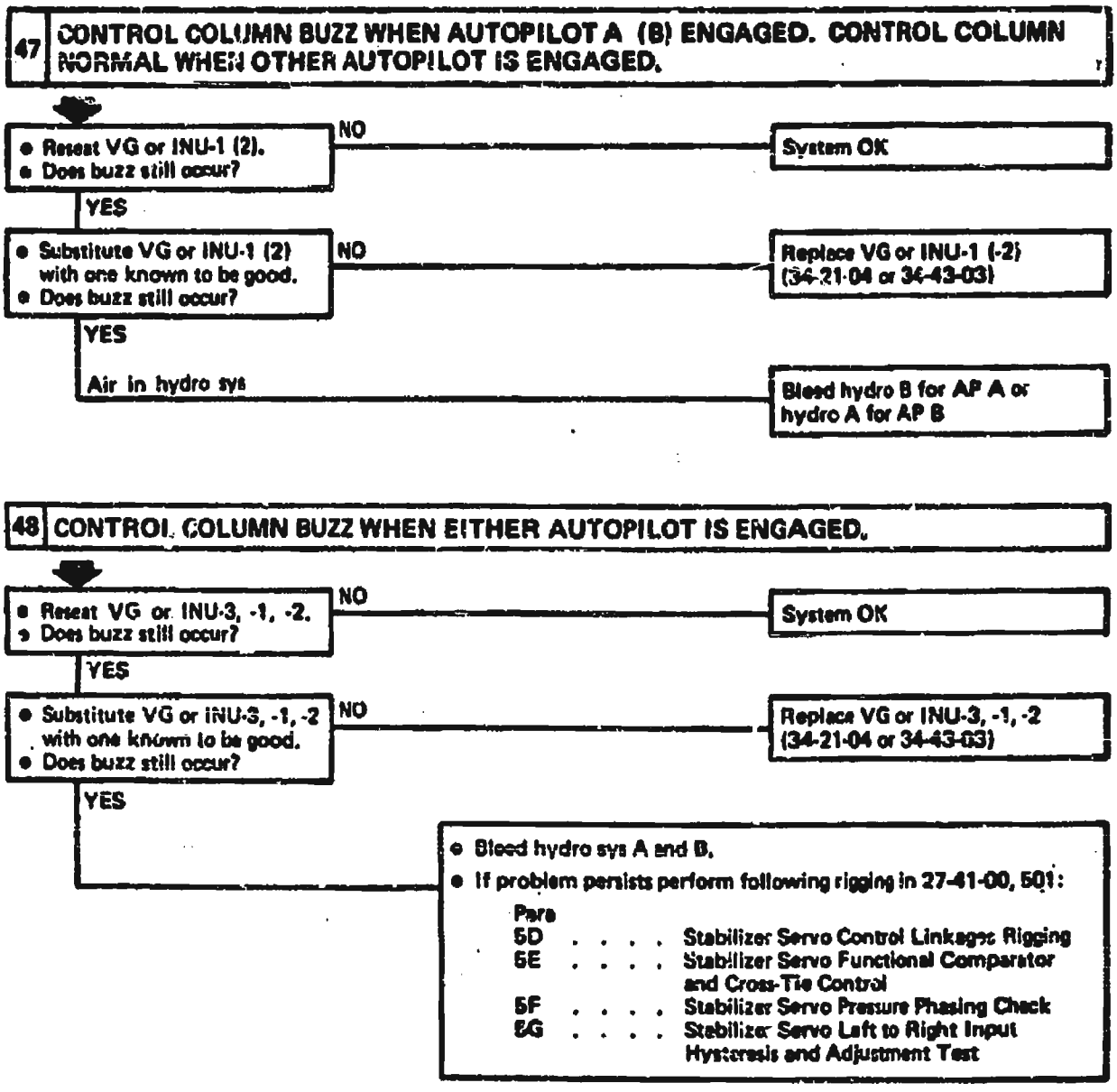
Autopilot Porpoising Faults
Figure 109 (Sheet 2)

EFFECTIVITY: ALL

0018


47
CONTROL COLUMN BUZZ WHEN AUTOPILOT A (B) ENGAGED. CONTROL COLUMN NORMAL WHEN OTHER AUTOPILOT IS ENGAGED.
• Reset VG or INU-1 (2).
• Does buzz still occur?
NO
System OK
YES
• Substitute VG or INU-1 (2) with one known to be good.
• Does buzz still occur?
NO
Replace VG or INU-1 (-2) (34-21-04 or 34-43-03)
YES
Air in hydro sys
Bleed hydro B for AP A or hydro A for AP B
48
CONTROL COLUMN BUZZ WHEN EITHER AUTOPILOT IS ENGAGED.
• Reset VG or INU-3, -1, -2.
• Does buzz still occur?
NO
System OK
YES
• Substitute VG or INU-3, -1, -2 with one known to be good.
• Does buzz still occur?
NO
Replace VG or INU-3, -1, -2 (34-21-04 or 34-43-03)
YES
• Bleed hydro sys A and B.
• If problem persists perform following rigging in 27-41-00, 501:
Para
5D . . . . Stabilizer Servo Control Linkage Rigging
5E . . . . Stabilizer Servo Functional Comparator and Cross-Tie Control
5F . . . . Stabilizer Servo Pressure Phasing Check
5G . . . . Stabilizer Servo Left to Right Input Hysteresis and Adjustment Test

M1-0100-22-1659

R R Control Column Buzz with AP Turned-on Faults
Figure 110

R EFFECTIVITY: ALL
R R
001B

AUTOPILOT A CWS/CMD MODE - ADJUSTMENT AND TEST

1. General

The fault detection test procedure in Paragraph 3 is used in conjunction with the fault isolation procedure in Paragraph 4. When a malfunction is confirmed during the test, refer to the fault number in Paragraph 4 for appropriate fault isolation.

2. Referenced Procedures

	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	FD Basic Mode - Fault Isolation
R	22-11-31	FD Vertical Speed Mode - Fault Isolation
R	22-11-33	FD Altitude Hold Mode - Fault Isolation
R	22-13-31	FD Heading Select Mode - Fault Isolation

3. Fault Detection Test

A. Preliminary Procedures

(1) Turn on APFDS as described in 22-12-00, maintenance practices.

(2) Set flaps to 33 degrees or greater.

B. Autopilot A CWS/CMD Mode Test

(1) In FESC, install AFCS/MLG accessory unit if removed.

(2) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker.

(3) On CB1, open NO. 2 SYSTEMS - YAW SAS (A23) circuit breaker.

RESULT:

On FCES panel, YAW SAS 2 switchlight indicates FAIL.

(4) Rapidly rotate Capt control wheel fully clockwise, and then back to center.

RESULT:

On surface position indicator (SPI), RUD indicator moves to right and then back to center.

On FCES panel, YAW SAS 1 switchlight does not indicate FAIL.

(5) On APFDS ENGAGE panel, set AP engage switch A to CWS.

RESULT:

On both AFCS WARNING indicators, AP LIMIT messages are not displayed.

Control columns and wheels remain in previously established position.

(6) On FCES panel, depress PITCH TRIM 2 switchlight to OFF.

RESULT:

AP engage switch A remains in CWS.

(7) On Capt control wheel, depress AP DISC switch.

RESULT:

AP engage switch A drops to OFF.

On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed.

Two-second aural warning sounds.

(8) On Capt control wheel, depress AP DISC switch.

RESULT:

On both AFCS WARNING indicators, AP DISC messages are removed and ALERT lights go dark.

R WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(9) In FESC, remove AFCS/MLG accessory unit.

(10) Set AP engage switch A to CMD.

(11) On HEADING/PITCH MODE panel, depress VS switchlight to on.

RESULT:

On Capt AFCS MODES annunciator, VS message is displayed.

AP engage switch A remains in CMD.

(12) On HEADING/PITCH MODE panel, set VERT SPEED thumbwheel for a plus 200 (blue background) indication.

RESULT:

AP engage switch A remains in CMD.

Control columns move aft and stop.

On center pedestal, pitch trim wheels rotate in nose-up direction and stop.

On both AFCS WARNING indicators, AP LIMIT messages and flashing ALERT lights are displayed after a short time interval.

R (13) On Capt control wheel, depress AP DISC switch.

RESULT:

AP engage switch A drops to OFF.

VS message is removed.

AP LIMIT messages are replaced by AP DISC messages.

Aural warning sounds.

(14) On Capt AFCS WARNING indicator, depress ALERT switchlight.

RESULT:

Flashing ALERT lights go dark on both indicators.

(15) On Capt AFCS WARNING indicator, depress ALERT switchlight.

RESULT:

AP DISC messages are removed from both indicators.

R (16) Rotate pitch trim wheels to an index setting of 5.5 and
R depress VS SWLT to OFF.

(17) Set AP engage switch B to CMD.

(18) On HEADING/PITCH MODE panel, depress HDG switchlight to on.

RESULT:

On F/O AFCS MODES annunciator, HDG SEL message is displayed.

AP engage switch B remains in CMD.

(19) On HEADING/PITCH MODE panel, slowly rotate HEADING knob to 10 degrees more than aircraft heading.

RESULT:

AP engage switch B remains in CMD.

Control wheels rotate.

(20) Slowly rotate HEADING knob to aircraft heading.

(21) On FCES panel, depress PITCH TRIM 2 switchlight to OFF.

RESULT:

AP engage switch B drops to OFF.

HDG SEL message is removed.

On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed. Aural warning sounds.

(22) Depress PITCH TRIM 2 switchlight to on.

(23) Set AP engage switch B to CWS.

RESULT:

On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are removed.

(24) On F/O control wheel, rapidly rotate pitch trim thumbwheel for nose-up trim.

RESULT:

Pitch trim wheels do not rotate.

(25) On HEADING/PITCH MODE panel, depress ALT switchlight to on.

RESULT:

AP engage switch A remains in CWS.

On Capt AFCS MODES annunciator, ALT message is displayed.

(26) On Capt control wheel, slowly pull column aft with increasing force until high resistance to further motion is felt.

RESULT:

On Capt AFCS MODES annunciator, ALT message is removed.

Maintain force and perform Step (27).

(27) On Capt control wheel, rapidly rotate pitch trim thumbwheel for nose-up trim.

RESULT:

Pitch trim wheels rotate.

(28) Release control wheel force.

(29) Depress ALT switchlight to on.

(30) On Capt control wheel, slowly push column forward with increasing force until high resistance to further motion is felt.

RESULT:

On Capt AFCS MODES annunciator, ALT message is removed.

(31) Release control wheel force.

(32) Depress ALT switchlight to on.

(33) On F/O control wheel, slowly pull column aft with increasing force until high resistance to further motion is felt.

RESULT:

R On Capt AFCS MODES annunciator, ALT message is
R removed.

R (34) Release control wheel force.

R (35) Depress ALT switchlight to on.

R (36) On F/O control wheel, slowly push column forward with
R increasing force until high resistance to further
R motion is felt.

R RESULT:

R On Capt AFCS MODES annunciator, ALT message is
R removed.

R (37) Release control wheel force.

R (38) On CB1, open NO.1 SYSTEMS - YAW SAS (A5) circuit
R breaker.

R RESULT:

R AP engage switch A drops to OFF.

R On FCES panel, YAW SAS 1 switchlight indicates
R FAIL.

R (39) Close A5 circuit breaker. Wait one minute, and then
R depress YAW SAS 1 switchlight to OFF. Wait 5 seconds
R and then depress YAW SAS 1 switchlight to on.

R (40) Close A24 circuit breaker.

R (41) Set AP engage switch A to CWS.

R (42) Slowly rotate F/O control wheel clockwise until
R position limit of approximately 85 degrees is reached.
R Release control wheel force. If AP engage switch A
R drops to OFF, reset to CWS. Immediately thereafter
R slowly rotate Capt control wheel clockwise to 85-degree
R limit.

R RESULT:

R Forces required to move control wheels to limits
R are approximately the same.

R (43) Release Capt control wheel force. If AP engage switch
R A drops to OFF, reset to CWS.

R (44) Slowly rotate F/O control wheel counterclockwise until
R position limit of approximately 85 degrees is reached.
R Release control wheel force. If AP engage switch A
R drops to OFF, reset to CWS. Immediately thereafter
R slowly rotate Capt control wheel counterclockwise to
R 85-degree limit.

R RESULT:

R Forces required to move control wheels to limits
R are approximately the same.

R (45) Release Capt control wheel force. If AP engage switch
R A drops to OFF, do not reset.

R (46) Set AP engage switch A to OFF.

R (47) Open A24 circuit breaker.

R (48) Set AP engage switch A to CWS.

R (49) On Capt control wheel, slowly rotate clockwise with
R increasing force.

R RESULT:

R AP engage switch A drops to OFF.

R (50) Close A23 and A24 circuit breakers.

R (51) Depress PITCH TRIM 2 switchlight to on.

R (52) In FESC, install AFCS/MLG accessory unit.

R (53) Set flaps to zero degrees.

R 4. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 4B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, references to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R Autopilot A CWS/CMD Mode Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
R 3B(3)	YAW SAS 2 switchlight does not indicate FAIL	(1)
R 3B(4)-1	No rudder motion indicated on SPI	(2)
R 3B(4)-2	YAW SAS 1 switchlight indicates FAIL	(3)
R 3B(5)-1	AP engage switch A cannot be raised to CWS	(4)
R 3B(5)-2	AP engage switch A will not hold in CWS	(5)
R 3B(5)-3	AP LIMIT message is displayed	(6)
R 3B(5)-4	Control column position changes	(7)
R 3B(5)-5	Control wheel position changes	(8)
R 3B(6)	AP engage switch A drops to OFF	(9)
R 3B(7)-1	AP engage switch A remains in CWS	(10)
R 3B(7)-2	AP DISC message not displayed on one AFCS WARNING indicator	(11)
R 3B(7)-3	Two second aural warning does not sound	(12)
R 3B(8)-1	AP DISC messages not removed	(13)
R 3B(8)-2	ALERT light not extinguished	(14)

R Autopilot A CWS/CMD Mode Fault Isolation Summary (Cont)
R Table 501

TEST REF.	FAULT	FAULT NO.
3B(10)-1	AP engage switch A cannot be set to CMD	(15)
3B(10)-2	AP engage switch A will not hold in CMD	(16)
3B(11)-1	VS message not displayed	(17)
3B(11)-2	AP engage switch A drops from CMD	(18)
3B(12)-1	AP engage switch A drops from CMD	(19)
3B(12)-2	Control columns do not move	(20)
3B(12)-3	Pitch trim wheels do not rotate	(21)
3B(12)-4	AP LIMIT message not displayed	(22)
3B(13)-1	AP engage switch A remains in CMD	(23)
3B(13)-2	VS message not removed	(24)
3B(13)-3	AP LIMIT messages not removed	(25)
3B(14)	Flashing ALERT light not extinguished	(26)
3B(15)	AP DISC message not removed	(27)
3B(18)-1	HDG SEL message not displayed	(28)
3B(18)-2	AP engage switch A drops from CMD	(29)
3B(19)-1	AP engage switch A drops from CMD	(30)
3B(19)-2	Control wheels do not rotate	(31)
3B(21)-1	AP engage switch A does not drop to OFF	(32)
3B(21)-2	HDG SEL message is not removed	(33)
3B(23)	AP DISC removed	(34)
3B(24)	Pitch trim wheels rotate	(35)
3B(25)-1	AP engage switch A drops to OFF	(36)
3B(25)-2	ALT message not displayed	(37)

Autopilot A CWS/CMD Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
3B(26)	ALT message not removed	(38)
3B(27)	Pitch trim wheels do not rotate	(39)
3B(30)	ALT message not removed	(40)
3B(33)	ALT message not removed	(41)
3B(36)	ALT message not removed	(42)
3B(38)-1	AP engage switch A does not drop to OFF	(43)
3B(38)-2	YAW SAS 1 switchlight FAIL legend not illuminated	(44)
3B(42)	Control wheel forces not equal	(45)
3B(44)	Control wheel forces not equal	(46)
3B(49)	AP engage switch A remains in CWS	(47)

Schematics for Fault Isolation of Autopilot A CWS/CMD Mode Problem
Table 502

TITLE	LOCATION
Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode Signal Flow Schematic	22-11-00, Schem 4
CWS Mode Engage Logic Schematic	22-09-02, Schem 9
CMD Mode Engage Logic Schematic	22-11-00, Schem 10
Pitch Command Valid Logic Schematic	22-11-00, Schem 11
Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic	22-13-00, Schem 4
Roll Servo Engage/Valid Logic Schematic	22-13-00, Schem 10
A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic	22-13-00, Schem 11

EFFECTIVITY: ALL

001B

R Schomatics for Fault Isolation of Autopilot A CWS/CMD Mode Problem
R (Cont)
R Table 502

TITLE	LOCATION
Roll Command Enable and FD Valid Logic Schematic	22-13-00, Schem 13

B. Autopilot A CWS/CMD Mode Faults

(1) Fault: YAW SAS 2 switchlight does not indicate FAIL

(a) Check for fault in yaw stability augmentation system (Ref. 22-15-00).

---

(2) Fault: No rudder motion indicated on SPI

(a) Check for fault in yaw stability augmentation system (Ref. 22-15-00).

---

(3) Fault: YAW SAS 1 switchlight indicates FAIL

(a) In FESC, remove roll computer No. 1 (Ref. 22-13-01). With roll computer removed, cycle YAW SAS 1 switchlight to on and rotate control wheel fully clockwise and then to center. Does YAW SAS 1 switchlight indicate FAIL?

Yes: Check for fault in yaw stability augmentation system (Ref. 22-15-00).

No: Replace roll computer No. 1 (Ref. 22-13-01).

---

(4) Fault: AP engage switch A cannot be raised to CWS

(a) On APFDS ENGAGE panel, set FD A to ON. On Capt ADI, is FD flag in view?

Yes: Go to Step (b).

No: Go to Step (c).

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(b) In FESC, remove AFCS/MLG accessory unit. On Capt ADI, is FD flag still displayed?

Yes: Perform fault isolation procedure for fault (5) in 22-10-31.

R

No: Replace AFCS/MLG accessory unit.

(c) From Step (a). In FESC, replace pitch computer No. 1 (Ref. 22-11-01). Establish original test conditions. Can AP engage switch A be raised to CWS?

Yes: Fault condition in original computer.

No: Go to Step (d).

(d) In FESC, replace roll computer No. 1 (Ref. 22-13-01). Establish original test conditions. Can AP engage switch A be raised to CWS?

Yes: Fault condition in original computer.

No: Go to Step (e).

(e) In FESC, replace yaw computer No. 1 (Ref. 22-15-01). Establish original test conditions. Can AP engage switch A be raised to CWS?

Yes: Fault condition in original computer.

No: Go to Step (f).

(f) In FESC, remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connectors J1B-04 and J3A-41. Is resistance less than 10 ohms?

Yes: Go to Step (h).

R No: Normal accelerometer No. 1 interlock jumper circuits fault (Ref. 22-11-00, SCHEM 9, Sheet 3). Go to Step (g).

(g) In galley ceiling zone 135, disconnect 2211-P5 connector from normal accelerometer J1. normal accelerometer J1. Connect ohmmeter between normal accelerometer connector J1-E and J1-J. Is resistance less than 10 ohms?

R Yes: Check aircraft wiring for open circuit (Ref. 22-11-00, SCHEM 9, Sheet 3).

No: Replace normal accelerometer unit (Ref. 22-11-02).

(h) From Step (f). In FESC, remove roll computer No. 1 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 1 rack connectors J1A-14 and J3A-03. Is resistance less than 10 ohms?

Yes: Go to Step (k).

No: Aileron authority limit switch circuit fault
R (Ref. 22-13-00, SCHEM 9, Sheet 1). Go to Step (i).

(i) In hydraulics service center, check rigging to aileron limiter switch mechanism (Ref. 27-11-38). Is rigging correct?

Yes: Go to Step (j).

No: Adjust or repair rigging as necessary (Ref. 27-11-38).

(j) In hydraulic service center (zone 147, FS 1353), connect ohmmeter between 2711-TB1-1 terminal A and 2711-TB2-1 terminal C. Is resistance less than 10 ohms?

Yes: Check airplane wiring for open circuit (Ref.
R 22-13-00, SCHEM 9).

No: Replace aileron limiter switch mechanism (Ref. 27-11-38).

(k) From Step (h). Connect ohmmeter between roll computer No. 1 rack connector J3A-20 and pitch computer No. 1 rack connector J3A-03. Is resistance less than 10 ohms?

Yes: Go to Step (l).

No: Capt and F/O control wheel A/P DISC switch circuit open. Isolate to Capt or F/O control wheel or aircraft wiring using Figure 109 in 22-11-00 and wiring diagrams referenced.

(l) Connect ohmmeter between pitch computer No. 1 rack connector J3A-03 and J3A-55. Is resistance less than 500 ohms?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01).

No: Go to Step (m).

(m) Remove APFDS ENGAGE panel (Ref. 22-10-01), and disconnect 2211-P23 plug. Connect ohmmeter between APFDS ENGAGE panel connector J1-B and J1-ZH. Is resistance less than 500 ohms?

Yes: Check airplane wiring for open-circuit fault between APFDS ENGAGE panel cable 2211-P23-ZH and pitch computer No. 1 rack connector J3A-55 (Ref.
R 22-11-00, SCHEM 9).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

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(5) Fault: AP engage switch A will not hold in CWS

(a) In FESC, remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J1A-04 and ground. Is resistance less than 3.5 ohms?

Yes: Pitch computer 26 VAC power supply output
R shorted (Ref. 22-11-00, SCHEM 2). Leave ohmmeter connected and go to Step (b).

No: Go to Step (h).

(b) In FESC, pull ADC No. 1 out of rack to extent necessary to break electrical connection (Ref. 34-14-01). It is not necessary to disconnect pneumatic lines to the computer. Is resistance between pitch computer No. 1 rack connector J1A-04 and ground less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (c).

No: Replace ADC No. 1 (Ref. 34-14-01). Replace pitch computer No. 1 when fault is corrected (Ref. 22-11-01).

(c) In FESC, at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between pitch computer No. 1 rack connector J1A-04 and ground less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (d).

No: Go to Step (g).

(d) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between pitch computer No. 1 rack connector J1A-04 and ground less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (e).

No: Leave ohmmeter connected and go to Step (f).

R (e) In afterbody area, zone 317, disconnect 2741-P3 cable from J1 on stabilizer autopilot control servo. Is resistance between pitch computer No. 1 rack connector J1A-04 and ground less than 10 ohms?

R Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-11-07). Replace pitch computer No. 1 when fault is corrected (Ref. 22-11-01).

R No: Replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 1 (Ref. 22-11-01) when fault is corrected.

R (f) From Step (d). In F/O control wheel hub, disconnect 2711-P2 cable. In FESC at base of F/O control column, connect 2711-P10 cable. Is resistance between pitch computer No. 1 rack connector J1A-04 and ground less than 10 ohms?

R Yes: Check for short-to-ground fault in F/O control column (Ref. WDM 22-11-07). Replace pitch computer No. 1 when fault is corrected (Ref. 22-11-01).

R No: Replace F/O control wheel (Ref. 27-11-01). Replace pitch computer No. 1 when fault is corrected (Ref. 22-11-01).

R (g) From Step (c). In Capt control wheel hub, disconnect 2711-P1 cable. In FESC at base of Capt control column, connect 2711-P11 cable. Is resistance between pitch computer No. 1 rack connector J1A-04 and ground less than 10 ohms?

R Yes: Check for short-to-ground fault in Capt control column (Ref. WDM 22-11-07). Replace pitch computer No. 1 when fault is corrected (Ref. 22-11-01).

R No: Replace Capt control wheel (Ref. 27-11-01). Replace pitch computer No. 1 when fault is corrected (Ref. 22-11-01).

R (h) From Step (a). Replace pitch computer No. 1 (Ref. 22-11-01). On APFDS ENGAGE panel, will AP engage switch A hold in CWS?

R Yes: Fault condition in original computer.

R No: Go to Step (i).

(i) In FESC, remove roll computer No. 1 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 1 rack connector J1A-04 and ground. Is resistance less than 6 ohms?

Yes: Roll computer 26 VAC power supply output
R shorted (Ref. 22-13-00, SCHEM 2). Leave ohmmeter connected and go to Step (j).

No: Go to Step (n).

(j) In FESC, remove compass coupler No. 1 (Ref. 34-22-03). Is resistance between roll computer No. 1 rack connector J1A-04 and ground less than 90 ohms?

Yes: Leave ohmmeter connected and go to Step (k).

No: Replace compass coupler No. 1 (Ref. 34-22-03). Replace roll computer No. 1 when fault
R is corrected (Ref. 22-02-01).

(k) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between roll computer No. 1 rack connector J1A-04 and ground less than 90 ohms?

Yes: Leave ohmmeter connected and go to Step (l).

No: Leave ohmmeter connected and go to Step (m).

(l) In left inboard wing area zone 551, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Is resistance between roll computer No. 1 rack connector J1A-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-13-01). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

No: Replace L inboard aileron servo control module (Ref. 27-11-17). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

(m) From Step (k). In Capt control wheel hub, disconnect 2711-P1 cable. In FESC at base of Capt control column connect 2711-P11 cable. Is resistance between roll computer No. 1 rack connector J1A-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in Capt control column (Ref. WM 22-15-01). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

No: Replace Capt control wheel (Ref. 27-11-01). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

(n) From Step (i). Connect ohmmeter between roll computer No. 1 rack connector J1B-04 and ground. Is resistance less than 90 ohms?

R Yes: Roll computer 26 VAC power supply output shorted (Ref. 22-13-00, SCHEM 2). Leave ohmmeter connected and go to Step (o).

No: Go to Step (r).

(o) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between roll computer No. 1 rack connector J1B-04 and ground less than 90 ohms?

Yes: Leave ohmmeter connected and go to Step (p).

No: Leave ohmmeter connected and go to Step (q).

(p) In left inboard wing area zone 511, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Is resistance between roll computer No. 1 rack connector J1B-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WM 22-13-01). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

No: Replace L inboard aileron servo control module (Ref. 27-11-17). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

(q) From Step (o). In F/O control wheel hub, disconnect 2711-P2 cable. In FESC at base of F/O control column, connect 2711-P10 cable. Is resistance between roll computer No. 1 rack connector J1B-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in F/O control column (Ref. WM 22-13-01). Replace roll computer No. 1 when fault is corrected.

No: Replace F/O control wheel (Ref. 27-11-01). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

(r) From Step (n). Connect ohmmeter between roll computer No. 1 rack connectors J3A-03 and J1B-14. Is resistance more than 10 ohms?

R Yes: Aileron authority limit switch No. 2 circuit open (Ref. 22-13-00, SCHEM 9). Go to Step (s).

No: Go to Step (u).

(s) In hydraulics service center, check rigging to aileron authority limit mechanism (Ref. 27-11-38). Is rigging properly adjusted?

Yes: Go to Step (t).

No: Adjust rigging for proper switch operation (Ref. 27-11-38).

(t) In hydraulic service center (zone 147, FS 1353), connect ohmmeter between 2711-TB2-1 terminal A and 2711-TB2-5 terminal A. Is resistance more than 10 ohms?

Yes: Replace aileron authority limit switch No. 2 assembly (Ref. 27-11-38).

R No: Check for open circuit in aircraft wiring (Ref. 22-13-00, SCHEM 9).

(u) From Step (r). Replace roll computer No. 1 (Ref. 22-13-01). On APFDS ENGAGE panel, will AP engage switch A hold in CWS?

Yes: Fault condition in original computer.

No: Go to Step (v).

(v) On APFDS ENGAGE panel set AP engage switch A to CWS and hold in this position throughout following series of tests. Remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J1B-03 and ground. Is resistance more than 65 ohms?

Yes: Go to Step (w).

No: Go to Step (y).

(w) Remove APFDS ENGAGE panel and disconnect 2211-P23 cable from J1 on panel. Connect ohmmeter between 2211-P23-W on cable and ground. Is resistance more than 65 ohms?

Yes: Go to Step (x).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open circuit in
R airplane wiring (Ref. 22-11-00, SCHEM 9).

(x) In afterbody zone 317, disconnect 2741-P3 cable from J1 of stabilizer autopilot control servo. Connect ohmmeter between J1-08 and J1-23 on servo. Is resistance more than 65 ohms?

Yes: Replace hydraulic system B solenoid shutoff valve on stabilizer autopilot control servo (Ref. 22-11-07). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for open circuit in airplane wiring
R (Ref. 22-11-00, SCHEM 9).

(y) From Step (v). Is resistance less than 35 ohms?

Yes: Go to Step (z).

No: Go to Step (ah).

(z) Reverse ohmmeter leads and connect them between pitch computer No. 1 rack connector J1B-03 and ground. Is resistance less than 35 ohms?

Yes: Go to Step (aa).

No: Replace hydraulic system B solenoid shutoff valve (Ref. 22-11-05) on stabilizer autopilot control servo. Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

(aa) Remove APFDS ENGAGE panel and disconnect 2211-P23 from J1 on panel. Connect ohmmeter between 2211-P23-W on cable and ground. Is resistance less than 35 ohms?

Yes: Go to Step (ab).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for short to ground in
R airplane wiring (Ref. 22-11-00, SCHEM 9). Replace

pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

(ab) In afterbody zone 317, disconnect 2741-P3 cable from J1 of stabilizer autopilot control servo. Connect ohmmeter between J1-08 and J1-23 on servo. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B solenoid shutoff valve (Ref. 22-11-07). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 1 when fault has been corrected (Ref. 22-11-01).

No: Go to Step (ac).

(ac) Connect ohmmeter between J1-23 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B solenoid shutoff valve (Ref. 22-11-07) on stabilizer autopilot control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ad).

(ad) Connect ohmmeter between J1-18 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B pressurizing solenoid valve (Ref. 22-11-07) on autopilot stabilizer control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ae).

(ae) Connect ohmmeter between J1-20 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B high level override solenoid shutoff valve on stabilizer autopilot control servo (Ref. 22-11-07). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (af).

(af) In afterbody zone 317, disconnect 2741-P14 from J2 on stabilizer autopilot control servo. Connect ohmmeter between J2-09 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B engage and override warning pressure switch (Ref. 22-11-09) on stabilizer autopilot control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ag).

(ag) Connect ohmmeter between J2-12 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B high level override force pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

R No: Check for short to ground in aircraft wiring (Ref. 22-11-00, SCHEM 9). Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

(ah) From Step (y). Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B solenoid shutoff valve (Ref. 22-11-07) on stabilizer autopilot control servo. Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ai).

(ai) Connect ohmmeter between pitch computer No. 1 rack connectors J1B-03 and J3B-66. Is resistance 50 (±15) ohms?

Yes: Leave ohmmeter connected and go to Step (an).

No: Leave ohmmeter connected and go to Step (aj).

(aj) Is resistance less than 35 ohms?

Yes: Leave ohmmeter connected and go to Step (ak).

No: Go to Step (al).

(ak) Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Go to Step (al).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open or short circuit fault in aircraft wiring (Ref. 22-11-00, R SCHEM 9). For short circuit fault replace pitch computer No. 1 (Ref. 22-11-01) when fault is corrected.

(al) From Steps (aj) and (ak). Remove APFDS ENGAGE panel and disconnect 2211-P23 from J1 on panel. Connect ohmmeter between 2211-P23-ZI and 2211-P23-P on cable. Is resistance 50 (±15) ohms?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open or short R circuit in aircraft wiring (Ref. 22-11-00, SCHEM R 9). For short circuit fault, replace pitch computer No. 1 (Ref. 22-11-01).

No: Go to Step (am).

(am) In afterbody zone 317, disconnect 2741-P3 cable from J1 of stabilizer autopilot control servo. Connect ohmmeter between J1-06 and J1-18 on servo. Is resistance 50 (±15) ohms?

Yes: Check for open or short circuit in aircraft R wiring (Ref. 22-11-00, SCHEM 9). For short circuit fault, replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace hydraulic system B engage and override warning pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). For short circuit fault, replace pitch computer No. 1 (Ref. 22-11-01).

(an) From Step (ai). Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B pressure solenoid shutoff valve (Ref. 22-11-07). Replace pitch computer No. 1 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ao).

(ao) Remove ohmmeter lead from pitch computer No. 1 rack connector J3B-66 and connect to pitch computer No. 1 rack connector J3A-18. Is resistance less than 35 ohms?

Yes: Replace hydraulic system B high level override pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Go to Step (ap).

(ap) In FESC, remove roll computer No. 1 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 1 rack connectors J1B-03 and J3A-49. Is resistance 50 (±15) ohms?

Yes: Go to Step (au).

No: Go to Step (aq).

(aq) Is resistance less than 35 ohms?

Yes: Go to Step (ar).

No: Go to Step (as).

(ar) Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Go to Step (as).

No: Replace avionic system No. 1 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. Replace roll computer No. 1 (Ref. 22-13-01) when fault has been corrected.

(as) From Steps (aq) and (ar). Remove APFDS ENGAGE panel and disconnect 2210-P23 from J1 on panel. Connect ohmmeter between 2210-P23-ZJ and 2210-P23-R on cable. Is resistance 50 (±15) ohms?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open or short
R circuit in aircraft wiring (Ref. 22-13-00, SCHEM
R 9). For short circuit fault, replace roll computer No. 1 when fault has been corrected (Ref. 22-13-01).

No: Go to Step (at).

(at) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Connect ohmmeter between J1-04 and J1-12 on servo. Is resistance 50 (±15) ohms?

Yes: Check for open or short circuit in aircraft
R wiring (Ref. 22-13-00, SCHEM 9). For short circuit fault, replace roll computer No. 1 (Ref. 22-13-01) when fault has been corrected.

No: Replace avionics system No. 1 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. If problem persists, replace L inboard aileron servo control module (Ref. 27-11-23). For short circuit fault, replace roll computer No. 1 (Ref. 22-13-01) when fault has been corrected.

(au) From Step (ap). Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Replace avionics system No. 1 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. Replace roll computer No. 1 (Ref. 22-13-01) when fault has been corrected.

No: Go to Step (av).

(av) Remove ohmmeter lead from roll computer No. 1 rack connector J3A-49 and connect to ground. Is resistance less than 500 ohms?

Yes: Go to Step (aw).

No: Go to Step (ay).

(aw) Remove APFDS ENGAGE panel and disconnect 2210-P23 from J1 on panel. Connect ohmmeter between 2210-P23-ZJ on cable and ground. Is resistance less than 500 ohms?

Yes: Go to Step (ax).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).
If problem persists, check for short to ground in
R aircraft wiring (Ref. 22-13-00, SCHEM 11). Replace roll computer No. 1 when fault has been corrected (Ref. 22-13-01).

(ax) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 on L inboard aileron servo control module. Connect ohmmeter between J1-12 on servo and ground. Is resistance less than 500 ohms?

Yes: Replace avionics system No. 1 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17). Replace roll computer No. 1 when fault has been corrected (Ref. 22-13-01).

R No: Check for short to ground in aircraft wiring (Ref. 22-13-00, SCHEM 9). Replace roll computer No. 1 when fault has been corrected (Ref. 22-13-01).

(ay) From Step (av). Connect ohmmeter between roll computer No. 1 rack connector J3A-13 and ground. Is resistance less than 1500 ohms?

Yes: Go to Step (az).

No: Go to Step (ba).

(az) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 or L inboard aileron servo control module. Connect ohmmeter between J1-08 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace avionics system No. 1 pressure switch (Ref. 27-11-37).

R No: Check for short-to-ground fault in aircraft wiring (Ref. 22-13-00, SCHEM 9).

(ba) From Step (ay). On APFDS ENGAGE panel, release AP engage switch A to OFF. Connect ohmmeter between pitch computer No. 1 rack connector J1A-52 and J1A-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bc).

No: Go to Step (bb).

(bb) In afterbody zone 317, disconnect 2741-P3 cable from J1 on stabilizer autopilot control servo. Connect ohmmeter between J1-10 and J1-09 on servo. Is resistance 1000 (±200) ohms?

Yes: Check for open or short circuit fault in

R aircraft wiring (Ref. 22-11-00, SCHEM 4).

No: Replace hydraulic system B EHV (avionics system No. 1) (Ref. 22-11-08). If problem

persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

(bc) From Step (ba). Remove ohmmeter lead from pitch computer No. 1 rack connector J1A-64 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (bd).

No: Go to Step (be).

(bd) In afterbody zone 317, disconnect 2741-P3 cable from J1 on stabilizer autopilot control servo. Connect ohmmeter between J1-09 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system B EHV (avionics system No. 1) (Ref. 22-11-08). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 4).

(be) From Step (bc). Connect ohmmeter between pitch computer No. 1 rack connector J1B-52 and J1B-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bg).

No: Go to Step (bf).

(bf) In afterbody zone 317, disconnect 2741-P3 cable from J1 on stabilizer autopilot control servo. Connect ohmmeter between J1-04 and J1-14 on servo. Is resistance 1000 (±200) ohms?

Yes: Check for open or short circuit fault in
R aircraft wiring (Ref. 22-11-00, SCHEM 4).

No: Replace hydraulic system B EHV (avionics system No. 1) (Ref. 22-11-08). If problem persists, stabilizer autopilot control servo (Ref. 22-11-05).

(bg) Does resistance noted in Step (be) differ from resistance noted in Step (ba) by more than 60 ohms?

Yes: Replace hydraulic system B EHV (avionic system No. 1) (Ref. 22-11-08).

No: Go to Step (bh).

(bh) Remove ohmmeter lead from pitch computer rack connector J1B-52 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (bi).

No: Go to Step (bj).

(bi) In afterbody zone 317, disconnect 2741-P3 cable from J1 on stabilizer autopilot control servo. Connect ohmmeter between J1-04 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system B EHV (avionics system No. 1) (Ref. 22-11-08). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

R No: Check for short-to-ground fault in aircraft wiring (Ref. 22-11-00, SCHEM 4).

(bj) From Step (bh). Connect ohmmeter between roll computer rack connector J1A-52 and J1A-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bl).

No: Go to Step (bk).

(bk) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Connect ohmmeter between J1-14 and J1-16 on servo. Is resistance 1000 (±200) ohms?

R Yes: Check for open or short-circuit fault in aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace hydraulic system B EHV (avionic system No. 1) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

(bl) From Step (bj). Remove ohmmeter lead from roll computer No. 1 rack connector J1A-64 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (bm).

No: Go to Step (bn).

(bm) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Connect ohmmeter between J1-16 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system B EHV (avionic system No. 1) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 4).

(bn) From Step (bh). Connect ohmmeter between roll computer No. 1 rack connector J1B-52 and J1B-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bp).

No: Go to Step (bo).

(bo) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Connect ohmmeter between J1-01 and J1-23. Is resistance 1000 (±200) ohms?

Yes: Check for open or short circuit fault in
R aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace hydraulic system B EHV (avionic system No. 1) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

(bp) From Step (bn). Does resistance noted in Step (bn) differ from resistance noted in Step (bj) by more than 60 ohms?

Yes: Replace hydraulic system B EHV (avionic system No. 1) (Ref. 27-11-21).

No: Go to Step (bq).

(bq) Remove ohmmeter lead from roll computer No. 1 rack connector J1B-64 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (br).

No: Go to Step (bs).

(br) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Connect ohmmeter between J1-23 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system B EHV (avionic system No. 1) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short to ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 5).

(bs) From Step (bq). Connect ohmmeter between pitch computer No. 1 rack connector J1A-51 and J1A-63. Is resistance 250 (±50) ohms?

Yes: Leave ohmmeter connected and go to Step (bu).

No: Go to Step (bt).

(bt) In afterbody zone 317, disconnect 2741-P3 cable from J1 on stabilizer autopilot control servo. Connect ohmmeter between J1-19 and J1-21 on servo. Is resistance 250 (±50) ohms?

Yes: Check for open or short-circuit fault in
R aircraft wiring (Ref. 22-11-00, SCHEM 4).

No: Replace stabilizer autopilot control servo (Ref. 22-11-05).

(bu) From Step (bs). Remove ohmmeter lead from pitch computer No. 1 rack connector J1A-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (bv).

No: Go to Step (bw).

(bv) In afterbody zone 137, disconnect 2741-P3 cable from J1 on stabilizer autopilot control servo. Connect ohmmeter between J1-19 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 4).

(bw) From Step (bu). Connect ohmmeter between pitch computer No. 1 rack connector J1B-51 and J1B-63. Is resistance 250 (±50) ohms?

Yes: Leave ohmmeter connected and go to Step (by).

No: Go to Step (bx).

(bx) In afterbody zone 317, disconnect 2741-P3 cable from J1 on autopilot stabilizer control servo. Connect ohmmeter between J1-02 and J1-11 on servo. Is resistance 250 (±50) ohms?

Yes: Check for open or short circuit fault in
R aircraft wiring (Ref. 22-11-00, SCHEM 5).

No: Replace stabilizer autopilot control servo (Ref. 22-11-05).

(by) From Step (bw). Remove ohmmeter lead from pitch computer No. 1 rack connector J1B-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (bz).

No: Go to Step (ca).

(bz) In afterbody zone 317, disconnect 2741-P3 cable from J1 on autopilot stabilizer control servo. Connect ohmmeter between J1-11 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for short or ground fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 4).

(ca) From Step (by). Connect ohmmeter between roll computer No. 1 rack connector J1A-51 and J1A-63. Is resistance 160 (±40) ohms?

Yes: Leave ohmmeter connected and go to Step (cc).

No: Go to Step (cb).

(cb) In left inboard wing zone 511, disconnect 2711-P3 from J1 of L inboard aileron servo control module. Connect ohmmeter between J1-19 and J1-22 on servo. Is resistance 160 (±40) ohms?

Yes: Check for open or short-circuit fault in
R aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace L inboard aileron servo control module (Ref. 27-11-17).

(cc) From Step (ca). Remove ohmmeter lead from roll computer No. 1 rack connector J1A-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (cd).

No: Go to Step (ce).

(cd) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 on L inboard aileron servo control module. Connect ohmmeter between J1-19 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 5).

(ce) From Step (cc). Connect ohmmeter between roll computer No. 1 rack connector J1B-51 and J1B-63. Is resistance 160 (±40) ohms?

Yes: Leave ohmmeter connected and go to Step (cg).

No: Go to Step (cf).

(cf) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 of L inboard aileron servo control module. Connect ohmmeter between J1-02 and J1-03 on servo. Is resistance 160 (±40) ohms?

Yes: Check for open or short circuit fault in
R aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace L inboard aileron servo control module (Ref. 27-11-17).

(cg) From Step (ce). Remove ohmmeter lead from roll computer No. 1 rack connector J1B-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (ch).

No: Go to Step (ci).

(ch) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 on L inboard aileron servo control module. Connect ohmmeter between J1-03 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short to ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 4).

(ci) From Step (cg). Install pitch computer No. 1 (Ref. 22-11-01). Install roll computer No. 1 (Ref. 22-13-01). Replace yaw computer No. 1 (Ref. 22-15-01). Establish original test conditions. On APFDS ENGAGE panel, will AP A switch remain in CWS position?

Yes: Fault condition in original yaw computer.

No: Go to Step (cj).

WARNING: INCORRECT JUMPER CONNECTIONS MAY RESULT IN DAMAGE TO SYSTEM COMPONENTS.

(cj) Remove roll computer No. 1 (Ref. 22-13-01). On CB1, open AFCS MODE IND (B1) circuit breaker. On CB2, open AFCS WARNING - CAPT (K18) circuit breaker. On roll computer No. 1 rack connectors, jumper J1B-06 to J1B-59, and jumper J3B-04 to J3A-45. Close B1 and K18 circuit breakers. On APFDS ENGAGE panel, will AP engage switch A remain in CWS?

Yes: Go to Step (ck).

No: Go to Step (cm).

(ck) In left inboard wing zone 511, disconnect 2711-P3 cable from J1 on L inboard aileron servo control module. On cable connector, jumper 2711-P3-05 to 2711-P3-08. Connect ohmmeter between roll computer No. 1 rack connector J3A-03 and J3A-13. Is resistance less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (cl).

No: Check for open-circuit fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 11).

(cl) Remove ohmmeter lead from J3A-03 and connect to ground. Is resistance less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 9.

No: Replace avionics system No. 1 pressure switch (Ref. 27-11-37). If problem persists, replace avionics system No. 1 shutoff valve (Ref. 27-11-20). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

(cm) From Step (cj). In afterbody zone 317, disconnect 2741-P14 cable from J2 on stabilizer autopilot control servo. Connect ohmmeter between J2-01 and ground. Is resistance less than 500 ohms?

Yes: Replace hydraulic system B engage and override warning pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Go to Step (cn).

(cn) Connect ohmmeter between 2741-P14-01 on cable and ground. Is resistance less than 500 ohms?

Yes: Leave cable disconnected and go to Step (co).

No: Replace hydraulic system B engage solenoid shutoff valve (Ref. 22-11-07). If problem persists, replace hydraulic system B pressurizing solenoid shutoff valve (Ref. 22-11-07). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-07).

(co) Temporarily identify pitch computers No. 1 and No. 2 and then remove both (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J3A-42 and ground. Is resistance less than 500 ohms?

Yes: Leave ohmmeter connected and go to Step (cp).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

(cp) In FESC, remove trim augmentation computer (Ref. 22-18-01). Is resistance less than 500 ohms?

R

Yes: Check for short-to-ground fault in aircraft wiring (Ref. 22-11-00, SCHEM 9, Sheet 2).

No: Replace trim augmentation computer (Ref. 22-18-01).

---

(6) Fault: AP LIMIT message is displayed

(a) Set AP engage switch A to CMD. Depress VS switchlight to on. On same panel, rotate thumbwheel for a VERT SPEED indication of +500 FPM (blue background). Does AP engage switch drop to OFF?

Yes: Perform steps (v) through (ac) of Fault (5) fault isolation procedure.

No: Go to Step (b).

(b) In FESC, remove pitch computer No. 2 (Ref. 22-11-01). Is AP LIMIT message displayed with AP engage switch A in CWS position?

Yes: Go to Step (c).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

(c) Replace pitch computer No. 1 (Ref. 22-11-01). Is AP LIMIT message displayed with AP engage switch A in CWS?

Yes: Go to Step (d).

No: Original computer is faulted.

(d) Remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J3A-42 and ground. Is resistance more than 10 ohms?

Yes: Go to Step (e).

No: Go to Step (f).

(e) In afterbody zone 317, disconnect 2741-P14 cable from J2 on stabilizer autopilot control servo. Connect ohmmeter between J2-01 and J2-2 on servo. Is resistance more than 10 ohms?

Yes: Replace hydraulic system B engage and override warning pressure switch (Ref. 22-11-09) on stabilizer autopilot control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

R No: Check for open-circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9, Sheet 1).

(f) In afterbody zone 317, disconnect 2741-P3 and 2741-P14 cables from J1 and J2 on stabilizer autopilot control servo. Connect ohmmeter between 2741-P3-18 and 2741-P14-09 on cables. Is resistance less than 10 ohms?

Yes: Replace hydraulic system B engage and override warning pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

R No: Check for open-circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9, Sheet 1).

---

(7) Fault: Control Column Position Changes

(a) In FESC, replace pitch computer No. 1 (Ref. 22-11-01). Repeat test. Does control column position change?

Yes: Go to Step (b).

No: Fault condition in original computer.

(b) In FESC, remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J1A-04 and J1A-24. Is resistance less than 5000 ohms?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Go to Step (c).

(c) Connect ohmmeter between pitch computer No. 1 rack connectors J1A-04 and J1B-24. Is resistance less than 5000 ohms?

Yes: Replace F/O control wheel (Ref. 27-11-01).

No: Replace Capt control wheel (Ref. 27-11-01). If problem persists, replace F/O control wheel (Ref. 27-11-01).

---

(8) Fault: Control wheel position changes

(a) Replace roll computer No. 1 (Ref. 22-13-01). Repeat test. Does control wheel position change?

R Yes: Go to Step (b).

R No: Fault condition in original computer.

R (b) Remove roll computer No. 1 (Ref. 22-13-01).
R Connect ohmmeter between roll computer No. 1 rack
R connector J1A-04 and J1A-25. Is resistance less
R than 5000 ohms?

R Yes: Replace Capt control wheel (Ref. 27-11-01).

R No: Go to Step (c).

R (c) Connect ohmmeter between roll computer No. 1 rack
R connector J1B-04 and J1B-25. Is resistance less
R than 5000 ohms?

R Yes: Replace F/O control wheel (Ref. 27-11-01).

R No: Replace Capt control wheel (Ref. 27-11-01).
R If problem persists, replace F/O control wheel
R (Ref. 27-11-01).

R ---

R (9) Fault: AP engage switch A drops to OFF

R (a) Close A24 circuit breaker. On APFDS ENGAGE panel,
R can AP engage switch B be set to CWS?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01).

R No: Replace trim augmentation computer (Ref.
R 22-18-01). If problem persists check for trim
R augmentation system fault (Ref. 22-18-00).

R ---

R (10) Fault: AP engage switch A remains in CWS

R (a) Remove pitch computer No. 1 (Ref. 22-11-01).
R Connect ohmmeter between pitch computer No. 1 rack
R connector J3A-03 and J3A-55. Depress and hold AP
R DISC switch on Capt control wheel. Is resistance
R less than 5000 ohms?

R Yes: Leave ohmmeter connected and go to Step (b).

R No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

(b) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J3A-03 and J3A-55 less than 5000 ohms?

Yes: Check for short-circuit fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 9).

No: Leave ohmmeter connected and go to Step (c).

(c) At base of Capt control column connect LH CONT WHL DISC 2711-P11. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J3A-03 and J3A-55 less than 5000 ohms?

Yes: Check for short-circuit in Capt control column wiring (Ref. WDM 22-11-07).

No: Replace Capt control wheel (Ref. 27-11-01).

---

(11) Fault: AP DISC message not displayed on one AFCS WARNING annunciator

(a) Can warning annunciator press-to-test (Ref. 22-12-01) be performed with no indicated faults?

Yes: Replace affected AFCS WARNING annunciator (Ref. 22-10-01). If problem persists check for open-circuit fault in aircraft wiring (Ref. 22-13-00, Fig. 111).

No: Perform warning annunciator fault isolation procedure (Ref. 22-12-01).

---

(12) Fault: Two-second aural warning does not sound

(a) Check for fault in aural warning system (Ref. 31-22-00).

---

(13) Fault: AP DISC messages not removed

(a) Is AP DISC message removed from one AFCS WARNING annunciator?

Yes: Replace annunciator which still displays AP DISC message (Ref. 22-10-06).

No: Go to Step (b).

(b) Replace roll computer No. 1 (Ref. 22-13-01). Repeat test. Are AP DISC messages removed?

Yes: Fault condition in original computer.

No: Replace roll computer No. 2 (Ref. 22-13-01).

---

(14) Fault: ALERT light not extinguished

(a) Replace annunciator which still displays ALERT light (Ref. 22-10-06).

---

(15) Fault: AP engage switch A cannot be set to CMD

R Perform fault isolation procedures for Fault (1)
R in 22-10-33, Page Block 101.

---

(16) Fault: AP engage switch A will not hold in CMD

(a) Replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(17) Fault: VS message not displayed

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

---

(18) Fault: AP engage switch A drops from CMD

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

---

(19) Fault: AP engage switch A drops from CMD

(a) Does switch drop to CWS position:

Yes: Perform FD vertical speed mode test (Ref. 22-12-11).

No: Perform fault isolation procedure for Fault (5).

---

(20) Fault: Control columns do not move

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

---

(21) Fault: Pitch trim wheels do not rotate

(a) Replace pitch computer No. 1 (Ref. 22-11-01). Repeat test. Do pitch trim wheels rotate?

Yes: Fault condition in original computer.

No: Replace trim augmentation computer (Ref. 22-18-01). If problem persists check trim augmentation for fault (Ref. 22-18-00).

---

(22) Fault: AP LIMIT message not displayed

(a) Is AP LIMIT message displayed on one AFCS WARNING indicator?

Yes: Replace AFCS WARNING indicator which does not display AP LIMIT message (Ref. 22-10-06). If problem persists, check for open-circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9).

No: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, in afterbody zone 317, replace hydraulic system B engage and override warning pressure switch (Ref. 22-11-09).

---

(23) Fault: AP engage switch A remains in CMD

(a) Remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J3A-03 and J3A-55. Depress and hold AP DISC switch on F/O control wheel. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (b).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

(b) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J3A-03 and J3A-55 less than 5000 ohms?

Yes: Check for short circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9).

No: Leave ohmmeter connected and go to Step (c).

(c) At base of F/O control column, connect RH CONT WHL DISC 2711-P10. In F/O control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J3A-03 and J3A-55 less than 5000 ohms?

Yes: Check for short circuit in F/O control column wiring (Ref. WDM 22-11-07).

No: Replace F/O control wheel.

---

(24) Fault: VS message not removed

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

---

(25) Fault: AP LIMIT messages not removed

(a) Is AP LIMIT message removed from one AFCS WARNING annunciator?

Yes: Replace AFCS WARNING annunciator which still displays AP LIMIT message (Ref. 22-10-06).

No: Replace pitch computer No. 1 (Ref. 22-11-01).

---

(26) Fault: Flashing ALERT light not extinguished

(a) Is ALERT light extinguished on Capt annunciator?

Yes: Replace F/O annunciator (ref. 22-10-06). If problem persists, check for open-circuit fault in aircraft wiring (Ref. 22-00-00, SCHEM 4).

No: Replace Capt annunciator (Ref. 22-10-06).

---

(27) Fault: AP DISC message not removed

(a) Is AP DISC message removed on Capt annunciator?

Yes: Replace F/O annunciator (Ref. 22-10-06).

No: Replace Capt annunciator (Ref. 22-10-06).

---

(28) Fault: HDG SEL message not displayed

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(29) Fault: AP engage switch A drops from CMD

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(30) Fault: AP engage switch A drops from CMD

(a) Does switch drop to CWS position?

Yes: Perform FD heading select mode test (Ref. 22-13-31).

No: Perform fault isolation for Fault (5).

---

(31) Fault: Control wheels do not rotate

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(32) Fault: AP engage switch A does not drop to OFF

(a) Replace pitch computer No. 1 (Ref. 22-11-01). Repeat test. Does switch drop to OFF?

Yes: Fault condition in original computer.

No: Replace trim augmentation computer (Ref. 22-18-01). If problem persists, check trim augmentation system for fault (Ref. 22-18-00).

---

(33) Fault: HDG SEL message is not removed

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(34) Fault: AP DISC message not removed

(a) Replace roll computer No. 1 (Ref. 22-13-01). Repeat test. Are AP DISC messages removed?

Yes: Fault condition in original computer.

No: Replace roll computer No. 2 (Ref. 22-13-01).

---

(35) Fault: Pitch trim wheels rotate

(a) Repalce pitch computer No. 1 (Ref. 22-11-01). Repeat test. Do pitch trim wheels rotate?

Yes: Replace trim augmentation computer (Ref. 22-18-01).

No: Fault condition in original computer.

---

(36) Fault: AP engage switch A drops to OFF

(a) Perform FD altitude hold mode test (Ref. 22-11-33).

---

(37) Fault: ALT message not displayed

(a) Perform FD altitude hold mode test (Ref. 22-11-33).

(38) Fault: ALT message not removed

(a) Replace pitch computer No. 1 (Ref. 22-11-01) and repeat test. On Capt AFCS MODES annunciator, is ALT message removed?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J1A-24 and J1A-36. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (c).

No: Leave ohmmeter connected and go to Step (e).

(c) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P16. Connect jumper between 2711-J11-43 and 2711-J11-42. Is resistance between rack connector J1A-24 and J1A-36 more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-11-03).

No: Leave ohmmeter connected and go to Step (d).

(d) Remove jumper from 2711-J11 connector and connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-35 and 2711-P1-19 on cable. Is resistance between rack connector J1A-24 and J1A-36 more than 160 ohms?

Yes: Check for open-circuit fault in Capt control column wiring (Ref. WDM 22-11-03).

No: Replace Capt control wheel (Ref. 27-11-01).

(e) From Step (b). Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (f).

No: Leave ohmmeter connected and go to Step (h).

(f) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between

rack connector J1A-24 and J1A-36 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-11-03).

No: Leave ohmmeter connected and go to Step (g).

(g) Connect 2711-P1 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J1A-24 and J1A-36 less than 80 ohms?

Yes: Check for short-circuit fault in Capt control column wiring (Ref. WDM 22-11-03).

No: Replace Capt control wheel (Ref. 27-11-01).

(h) From Step (e). Remove ohmmeter lead from rack connector J1A-36 and connect to ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (i).

No: Go to Step (k).

(i) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J1A-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-11-03).

No: Leave ohmmeter connected and go to Step (j).

(j) Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J1A-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in Capt control column wiring (Ref. WDM 22-11-03).

No: Replace Capt control wheel (Ref. 27-11-01).

(k) From Step (h). In FESC, partially remove air data computer No. 1 to the extent necessary to break electrical connection (Ref. 34-14-01). It is not necessary to break pneumatic connections. Connect ohmmeter between pitch computer No. 1 rack

connector J1A-04 and ground. Is resistance more than 15 ohms?

Yes: Leave ohmmeter connected and go to Step (1).

No: Replace Capt control wheel (Ref. 27-11-01).

(l) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Connect jumper between 2711-J11-16 and 2711-J11-3. Is resistance between rack connector J1A-04 and ground more than 10 ohms?

Yes: Check aircraft wiring for open-circuit fault (Ref. WDM 22-11-07).

No: Leave ohmmeter connected and go to Step (m).

(m) Remove jumper from 2711-J11. Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-36 and 2711-P1-20 on cable. Is resistance between rack connector J1A-04 and ground more than 10 ohms?

Yes: Check Capt control column wiring for open-circuit fault (Ref. WDM 22-11-07).

No: Replace Capt control wheel (Ref. 27-11-01).

---

(39) Fault: Pitch trim wheels do not rotate

(a) Replace pitch computer No. 1 (Ref. 22-11-01). Repeat test. Do pitch trim wheels rotate?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Replace trim augmentation computer (Ref. 22-18-01). Do pitch trim wheels rotate?

Yes: Fault condition in original computer.

No: Check for trim augmentation system (Ref. 22-18-00).

---

(40) Fault: ALT message not removed

(a) Replace pitch computer No. 1 (Ref. 22-11-01) and repeat test. Is ALT message removed?

Yes: Fault condition in original computer.

No: Replace Capt control wheel (Ref. 27-11-01).

---

(41) Fault: ALT message not removed

(a) Replace pitch computer No. 1 (Ref. 22-11-01) and repeat test. On Capt AFCS MODES annunciator, is ALT message removed?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Remove pitch computer No. 1 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 1 rack connector J1B-24 and J1B-36. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (c).

No: Leave ohmmeter connected and go to Step (e).

(c) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Connect jumper between 2711-T10-36 and 2711-J10-37. Is resistance between rack connector J1B-24 and J1B-36 more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-11-03).

No: Leave ohmmeter connected and go to Step (d).

(d) Remove jumper from 2711-J10 connector. Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Connect jumper between 2711-P2-2 and 2711-P2-22 on cable. Is resistance between rack connector J1B-24 and J1B-36 more than 160 ohms?

Yes: Check for open-circuit fault in F/O control column (Ref. WDM 22-11-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(e) From Step (b). Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (f).

No: Leave ohmmeter connected and go to Step (h).

(f) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J1B-24 and J1B-36 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-11-03).

No: Leave ohmmeter connected and go to Step (g).

(g) Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J1B-24 and J1B-36 less than 80 ohms?

Yes: Check for short-circuit fault in F/O control column wiring (Ref. WDM 22-11-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(h) From Step (e). Connect ohmmeter between pitch computer No. 1 rack connector and ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (i).

No: Go to Step (k).

(i) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J1B-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-11-03).

No: Leave ohmmeter connected and go to Step (j).

(j) Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J1B-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in F/O control column wiring (Ref. WDM 22-11-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(k) From Step (h). In FESC, partially remove air data computer No. 1 to the extent necessary to break electrical connection (Ref. 34-14-01). It is not necessary to break pneumatic connections. Connect ohmmeter between pitch computer No. 1 rack connector J1A-04 and ground. Is resistance more than 15 ohms?

Yes: Leave ohmmeter connected and go to Step (l).

No: Replace F/O control wheel (Ref. 27-11-01).

(l) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Connect jumper between 2711-J10-12 and 2711-J10-02. Is resistance between rack connector J1B-04 and ground more than 10 ohms?

Yes: Check aircraft wiring for open-circuit fault (Ref. WDM 22-11-07).

No: Leave ohmmeter connected and go to Step (m).

(m) Remove jumper from 2711-J10. Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Connect jumper between 2711-P2-21 and 2711-P2-10 on cable. Is resistance between rack connector J1B-04 and ground more than 10 ohms?

Yes: Check F/O control column wiring for open-circuit fault (Ref. WDM 22-11-07).

No: Replace F/O control wheel (Ref. 27-11-01).

---

(42) Fault: ALT message not removed

(a) Replace pitch computer No. 1 (Ref. 22-11-01) and repeat test. Is ALT message removed?

Yes: Fault condition in original computer.

No: Replace F/O control wheel (Ref. 27-11-01).

---

(43) Fault: AP engage switch A does not drop to OFF

(a) Replace roll computer No. 1 (Ref. 22-13-01). Repeat test. Does switch drop to OFF?

Yes: Fault condition in original computer.

No: Replace pitch computer No. 1 (Ref. 22-11-01).

---

(44) Fault: YAW SAS 1 switchlight FAIL legend not illuminated

(a) Check for yaw stability augmentation system (Ref. 22-18-00).

---

(45) Fault: Control wheel forces not equal

(a) Replace roll computer No. 1 (Ref. 22-13-01). Repeat test. Are forces approximately equal?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Is Capt control wheel force greater?

Yes: Go to Step (c).

No: Go to Step (o).

(c) Remove roll computer No. 1 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 1 rack connector J1A-25 and J1A-37. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (d).

No: Leave ohmmeter connected and go to Step (f).

(d) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Connect jumper between 2711-J11-40 and 2711-J11-41. Is resistance between rack connector J1A-25 and J1A-37 more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 27-13-03).

No: Leave ohmmeter connected and go to Step (e).

(e) Remove jumper from 2711-J11. Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-18

and 2711-P1-38 on cable. Is resistance between rack connector J1A-25 and J1A-37 more than 160 ohms?

Yes: Check for open-circuit fault in Capt control column wiring (Ref. WDM 22-13-03).

No: Replace Capt control wheel (Ref. 27-11-01).

(f) From Step (c). Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (g).

No: Leave ohmmeter connected and go to Step (i).

(g) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J1A-25 and J1A-37 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-13-03).

No: Leave ohmmeter connected and go to Step (h).

(h) Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J1A-25 and J1A-37 less than 80 ohms?

Yes: Check for short-circuit fault in Capt control column wiring (Ref. WDM 22-13-03).

No: Replace Capt control wheel (Ref. 27-11-01).

(i) From Step (f). Connect ohmmeter roll computer No. 1 rack connector J1A-25 and ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (j).

No: Go to Step (l).

(j) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J1A-25 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (WDM 22-13-03).

No: Leave ohmmeter connected and go to Step (k).

(k) Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J1A-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in Capt control column wiring (Ref. WDM 22-13-03).

No: Replace Capt control wheel (Ref. 27-11-01).

(l) From Step (i). In FESC, remove compass coupler No. 1 (Ref. 34-22-06). Connect ohmmeter between roll computer No. 1 rack connector J1A-04 and ground. Is resistance more than 70 ohms?

Yes: Leave ohmmeter connected and go to Step (m).

No: Replace Capt control wheel (Ref. 27-11-01).

(m) In FESC at base of Capt control column, disconnect 2711-P11 cable. Connect jumper between 2711-J11-17 and 2711-J11-4. Is resistance between rack connector J1A-04 and ground more than 10 ohms?

Yes: Check for open-circuit fault in airplane wiring (Ref. WDM 22-13-01).

No: Leave ohmmeter connected and go to Step (n).

(n) Remove jumper from 2711-J11. Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-37 and 2711-P1-39 on cable. Is resistance between rack connector J1A-04 and ground more than 10 ohms?

Yes: Check Capt control column wiring for open-circuit fault (Ref. WDM 22-13-01).

No: Replace Capt control wheel (Ref. 27-11-01).

(o) From Step (b). Remove roll computer No. 1 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 1 rack connector J1B-25 and J1B-37. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (p).

No: Leave ohmmeter connected and go to Step (r).

(p) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Connect jumper between 2711-J10-38 and 2711-J10-39 on cable. Is resistance between rack connector J1B-25 and J1B-37 more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-13-03).

No: Leave ohmmeter connected and go to Step (q).

(q) Remove jumper from 2711-J10 connector. Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Connect jumper between 2711-P2-9 and 2711-P2-41 on cable. Is resistance between rack connector J1B-25 and J1B-37 more than 160 ohms?

Yes: Check for open-circuit fault in F/O control column wiring (Ref. WDM 22-13-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(r) From Step (o). Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (s).

No: Leave ohmmeter connected and go to Step (u).

(s) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J1B-25 and J1B-37 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-13-03).

No: Leave ohmmeter connected and go to Step (t).

(t) Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J1B-25 and J1B-37 less than 80 ohms?

Yes: Check for short-circuit fault in F/O control column wiring (Ref. WDM 22-13-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(u) From Step (r). Connect ohmmeter between roll computer No. 1 rack connector J1B-25 and ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (v).

No: Go to Step (x).

(v) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J1B-25 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-13-03).

No: Leave ohmmeter connected and go to Step (w).

(w) Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J1B-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in F/O control column wiring (Ref. WDM 22-13-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(x) From Step (u). Connect ohmmeter between roll computer No. 1 rack connector J1B-04 and ground. Is resistance more than 70 ohms?

Yes: Leave ohmmeter connected and go to Step (y).

No: Replace F/O control wheel (Ref. 27-11-01).

(y) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Connect jumper between 2711-J10-38 and 2711-J10-39. Is resistance between rack connector J1B-04 and ground more than 10 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-13-03).

No: Leave ohmmeter connected and go to Step (z).

(z) Remove jumper from 2711-J10. Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Connect jumper between 2711-P2-9 and 2711-P2-41 on cable. Is resistance between rack connector J1B-04 and ground more than 10 ohms?

Yes: Check F/O control column wiring for open-circuit fault (Ref. WDM 22-13-03).

No: Replace F/O control wheel (Ref. 27-11-01).

---

(46) Fault: Control wheel forces not equal

(a) Replace roll computer No. 1 (Ref. 22-13-01). Repeat test. Are forces approximately equal?

Yes: Fault condition in original computer.

No: Replace high-force control wheel (Ref. 27-11-01).

---

(47) Fault: AP engage switch A remains in CWS

(a) Replace pitch computer No. 1 (Ref. 22-11-01). Repeat test. Does AP engage switch A drop to OFF?

Yes: Fault condition in original computer.

No: Replace roll computer No. 2 (Ref. 22-13-01).

AUTOPILOT B CWS/CMD MODE - ADJUSTMENT AND TEST

1. General

The fault detection test procedure in Paragraph 3 is used in conjunction with the fault isolation procedure in Paragraph 4. When a malfunction is confirmed during the test, refer to the fault number in Paragraph 4 for appropriate fault isolation.

2. Referenced Procedures

	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	FD Basic Mode - Fault Isolation
R	22-11-33	FD Altitude Hold Mode - Fault Isolation
R	22-11-31	FD Vertical Speed Mode - Fault Isolation
R	22-13-31	FD Heading Select Mode - Fault Isolation

3. Fault Detection Test

A. Preliminary Procedures

(1) Turn on APFDS as described in 22-12-00, maintenance practices.

(2) Set flaps to 33 degrees or greater.

B. Autopilot B CWS/CMD Mode Test

(1) In FESC, install AFCS/MLG accessory unit if removed.

(2) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker.

(3) On CB1, open NO. 1 SYSTEMS - YAW SAS (A5) circuit breaker.

RESULT:

On FCES panel, YAW SAS 1 switchlight indicates FAIL.

(4) Rapidly rotate F/O control wheel fully clockwise, and then back to center.

RESULT:

On surface position indicator (SPI), RUD indicator moves to right and then back to center.

On FCES panel, YAW SAS 2 switchlight does not indicate FAIL.

(5) On APFDS ENGAGE panel, set AP engage switch B to CWS.

RESULT:

On both AFCS WARNING indicators, AP LIMIT messages are not displayed.

Control columns and wheels remain in previously established position.

(6) On FCES panel, depress PITCH TRIM 1 switchlight to OFF.

RESULT:

AP engage switch B remains in CWS.

(7) On F/O control wheel, depress AP DISC switch.

RESULT:

AP engage switch B drops to OFF.

On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed.

Two-second aural warning sounds.

(8) On F/O control wheel, depress AP DISC switch.

RESULT:

On both AFCS WARNING indicators, AP DISC messages are removed and ALERT lights go dark.

R WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(9) In FESC, remove AFCS/MLG accessory unit.

(10) Set AP engage switch B to CMD.

(11) On HEADING/PITCH MODE panel, depress VS switchlight to on.

RESULT:

On F/O AFCS MODES annunciator, VS message is displayed.

AP engage switch B remains in CMD.

(12) On HEADING/PITCH MODE panel, set VERT SPEED thumbwheel for a plus 200 (blue background) indication.

RESULT:

AP engage switch B remains in CMD.

Control columns move aft and stop.

On center pedestal, pitch trim wheels rotate in nose-up direction and stop.

On both AFCS WARNING indicators, AP LIMIT messages and flashing ALERT lights are displayed after a short time interval.

R (13) On F/O control wheel, depress AP DISC switch.

RESULT:

AP engage switch B drops to OFF.

VS message is removed.

AP LIMIT messages are replaced by AP DISC messages.

Aural warning sounds.

(14) On F/O AFCS WARNING indicator, depress ALERT switchlight.

RESULT:

Flashing ALERT lights go dark on both indicators.

(15) On F/O AFCS WARNING indicator, depress ALERT switchlight.

Result:

AP DISC messages are removed from both indicators.

R (16) Rotate pitch trim wheels to an index setting of 5.5 and
R depress VS SWLT to OFF.

(17) Set AP engage switch B to CMD.

(18) On HEADING/PITCH MODE panel, depress HDG switchlight to on.

RESULT:

On F/O AFCS MODES annunciator, HDG SEL message is displayed.

AP engage switch B remains in CMD.

(19) On HEADING/PITCH MODE panel, slowly rotate HEADING knob to 10 degrees more than aircraft heading.

RESULT:

AP engage switch B remains in CMD.

Control wheels rotate.

(20) Slowly rotate HEADING knob to aircraft heading.

(21) On FCES panel, depress PITCH TRIM 2 switchlight to OFF.

RESULT:

AP engage switch B drops to OFF.

HDG SEL message is removed.

On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed. Aural warning sounds.

(22) Depress PITCH TRIM 2 switchlight to on.

(23) Set AP engage switch B to CWS.

RESULT:

On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are removed.

(24) On F/O control wheel, rapidly rotate pitch trim thumbwheel for nose-up trim.

RESULT:

Pitch trim wheels do not rotate.

(25) On HEADING/PITCH MODE Panel, depress ALT switchlight to on.

RESULT:

AP engage switch B remains in CWS.

On F/O AFCS MODES annunciator, ALT message is displayed.

(26) On F/O control wheel, slowly pull column aft with increasing force until high resistance to further motion is felt.

RESULT:

On F/O AFCS MODES annunciator, ALT message is removed.

Maintain force and perform Step (27).

(27) On F/O control wheel, rapidly rotate pitch trim thumbwheel for nose-up trim.

RESULT:

Pitch trim wheels rotate.

(28) Release control wheel force.

(29) Depress ALT switchlight to on.

(30) On F/O control wheel, slowly push column forward with increasing force until high resistance to further motion is felt.

RESULT:

On F/O AFCS MODES annunciator, ALT message is removed.

(31) Release control wheel force.

(32) DepressALT switchlight to on.

(33) On Capt control wheel, slowly pull column aft with increasing force until high resistance to further motion is felt.

RESULT:

R On F/O AFCS MODES annunciator, ALT message is
R removed.

R (34) Release control wheel force.

R (35) Depress ALT switchlight to on.

R (36) On Capt control wheel, slowly push column forward with
R increasing force until high resistance to further
R motion is felt.

R RESULT:

R On F/O AFCS MODES annunciator, ALT message is
R removed.

R (37) Release control wheel force.

R (38) On CB1, open NO. 2 SYSTEMS - YAW SAS (A23) circuit
R breaker.

R RESULT:

R AP engage switch B drops to OFF.

R On FCES panel, YAW SAS 2 switchlight indicates
R FAIL.

R (39) Close A23 circuit breaker. Wait one minute, and then
R depress YAW SAS 2 switchlight to OFF. Wait 5 seconds
R and then depress YAW SAS 2 switchlight to on.

R (40) Close A6 circuit breaker.

R (41) Set AP engage switch B to CWS.

R (42) Slowly rotate Capt control wheel clockwise until
R position limit of approximately 85 degrees is reached.
R Release control wheel force. If AP engage switch B
R drops to OFF, reset to CWS. Immediately thereafter
R slowly rotate F/O control wheel clockwise to 85-degree
R limit.

R RESULT:

R Forces required to move control wheels to limits
R are approximately the same.

R (43) Release F/O control wheel force. If AP engage switch B
R drops to OFF, reset to CWS.

R (44) Slowly rotate Capt control wheel counter-clockwise until position limit of approximately 85 degrees is reached. Release control wheel force. If AP engage switch B drops to OFF, reset to CWS. Immediately thereafter slowly rotate F/O control wheel counter-clockwise to 85-degree limit.

R RESULT:

Forces required to move control wheels to limits are approximately the same.

R (45) Release F/O control wheel force. If AP engage switch B drops to OFF, do not reset.

R (46) Set AP engage switch B to OFF.

R (47) Open A6 circuit breaker.

R (48) Set AP engage switch B to CWS.

R (49) On F/O control wheel, slowly rotate clockwise with increasing force.

R RESULT:

AP engage switch B drops to OFF.

R (50) Close A5 and A6 circuit breakers.

R (51) Depress PITCH TRIM 1 switchlight to on.

R (52) In FESC, install AFCS/MLG accessory unit.

R (53) Set flaps to zero degrees.

R 4. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 4B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, references to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R Autopilot B CWS/CMD Mode Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
3B(3)	YAW SAS 1 switchlight does not indicate FAIL	(1)
3B(4)-1	No rudder motion indicated on SPI	(2)
3B(4)-2	YAW SAS 2 switchlight indicates FAIL	(3)
3B(5)-1	AP engage switch B cannot be raised to CWS	(4)
3B(5)-2	AP engage switch B will not hold in CWS	(5)
3B(5)-3	AP LIMIT message is displayed	(6)
3B(5)-4	Control column position changes	(7)
3B(5)-5	Control wheel position changes	(8)
3B(6)	AP engage switch B drops to OFF	(9)
3B(7)-1	AP engage switch B remains in CWS	(10)
3B(7)-2	AP DISC message not displayed on one AFCS WARNING indicator	(11)
3B(7)-3	Two second aural warning does not sound	(12)
3B(8)-1	AP DISC messages not removed	(13)
3B(8)-2	ALERT light not extinguished	(14)

Autopilot B CWS/CMD Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
3B(10)-1	AP engage switch B cannot be set to CMD	(15)
3B(10)-2	AP engage switch B will not hold in CMD	(16)
3B(11)-1	VS message not displayed	(17)
3B(11)-2	AP engage switch B drops from CMD	(18)
3B(12)-1	AP engage switch B drops from CMD	(19)
3B(12)-2	Control columns do not move	(20)
3B(12)-3	Pitch trim wheels do not rotate	(21)
3B(12)-4	AP LIMIT message not displayed	(22)
3B(13)-1	AP engage switch B remains in CMD	(23)
3B(13)-2	VS message not removed	(24)
3B(13)-3	AP LIMIT messages not removed	(25)
3B(14)	Flashing ALERT light not extinguished	(26)
3B(15)	AP DISC message not removed	(27)
3B(18)-1	HDG SEL message not displayed	(28)
3B(18)-2	AP engage switch B drops from CMD	(29)
3B(19)-1	AP engage switch B drops from CMD	(30)
3B(19)-2	Control wheels do not rotate	(31)
3B(21)-1	AP engage switch B does not drop to OFF	(32)
3B(21)-2	HDG SEL message is not removed	(33)
3B(23)	AP DISC removed	(34)
3B(24)	Pitch trim wheels rotate	(35)
3B(25)-1	AP engage switch B drops to OFF	(36)
3B(25)-2	ALT message not displayed	(37)

EFFECTIVITY: ALL

001B

R Autopilot B CWS/CMD Mode Fault Isolation Summary (Cont)
R Table 501

TEST REF.	FAULT	FAULT NO.
3B(26)	ALT message not removed	(38)
3B(27)	Pitch trim wheels do not rotate	(39)
3B(30)	ALT message not removed	(40)
3B(33)	ALT message not removed	(41)
3B(36)	ALT message not removed	(42)
3B(38)-1	AP engage switch B does not drop to OFF	(43)
3B(38)-1	YAW SAS 2 switchlight FAIL legend not illuminated	(44)
3B(42)	Control wheel forces not equal	(45)
3B(44)	Control wheel forces not equal	(46)
3B(49)	AP engage switch B remains in CWS	(47)

R Schematics for Fault Isolation of Autopilot B CWS/CMD Mode Problem
R Table 502

TITLE	LOCATION
Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode Signal Flow Schematic	22-11-00, Schem 4
CWS Mode Engage Logic Schematics	22-11-00, Schem 9
CMD Mode Engage Logic Schematic	22-11-00, Schem 10
Pitch Command Valid Logic Schematic	22-11-00, Schem 11
Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic	22-13-00, Schem 4
Roll Servo Engage/Valid Logic Schematic	22-13-00, Schem 10
A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic	22-13-00, Schem 11

R Schematics for Fault Isolation of Autopilot B CWS/CMD Mode Problem
R (Cont)
R Table 502

TITLE	LOCATION
Roll Command Enable and FD Valid Logic Schematic	22-13-00, Schem 13

B. Autopilot B CWS/CMD Mode Faults

(1) Fault: YAW SAS 1 switchlight does not indicate FAIL

(a) Check for fault in yaw stability augmentation system (Ref. 22-15-00).

---

(2) Fault: No rudder motion indicated on SPI

(a) Check for fault in yaw stability augmentation system (Ref. 22-15-00).

---

(3) Fault: YAW SAS 2 switchlight indicates FAIL

(a) In FESC, remove roll computer No. 2 (Ref. 22-13-01). With roll computer removed, cycle YAW SAS 2 switchlight to on and rotate control wheel fully clockwise and then to center. Does YAW SAS 2 switchlight indicate FAIL?

Yes: Check for fault in yaw stability augmentation system (Ref. 22-15-00).

No: Replace roll computer No. 2 (Ref. 22-13-01).

---

(4) Fault: AP engage switch B cannot be raised to CWS

(a) On APFDS ENGAGE panel, set FD B to ON. On F/O ADI, is FD flag in view?

Yes: Go to Step (b).

No: Go to Step (c).

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON, INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

(b) In FESC, remove AFCS/MLG accessory unit. On F/O ADI, is FD flag still displayed?

R Yes: Perform fault isolation procedure for Fault (7) in 22-10-31.

No: Replace AFCS/MLG accessory unit.

(c) From Step (a). In FESC, replace pitch computer No. 2 (Ref. 22-11-01). Establish original test conditions. Can AP engage switch B be raised to CWS?

Yes: Fault condition in original computer.

No: Go to Step (d).

(d) In FESC, replace roll computer No. 2 (Ref. 22-13-01). Establish original test conditions. Can AP engage switch B be raised to CWS?

Yes: Fault condition in original computer.

No: Go to Step (e).

(e) In FESC, replace yaw computer No. 2 (Ref. 22-15-01). Establish original test conditions. Can AP engage switch B be raised to CWS?

Yes: Fault condition in original computer.

No: Go to Step (f).

(f) In FESC, remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connectors J2B-04 and J4A-41. Is resistance less than 10 ohms?

Yes: Go to Step (h).

R No: Normal accelerometer No. 2 interlock jumper circuit fault (Ref. 22-11-00, SCHEM 9, Sheet 3). Go to Step (g).

(g) In galley ceiling zone 135, disconnect 2211-P6 connector from normal accelerometer J2. Connect ohmmeter between normal accelerometer connector J2-E and J2-J. Is resistance less than 10 ohms?

R Yes: Check aircraft wiring for open circuit (Ref. 22-11-00, SCHEM 9, Sheet 3).

No: Replace normal accelerometer unit (Ref. 22-11-02).

(h) From Step (f). In FESC, remove roll computer No. 2 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 2 rack connectors J2A-14 and J4A-03. Is resistance less than 10 ohms?

Yes: Go to Step (k).

No: Aileron authority limit switch circuit fault (Ref. 22-13-00, SCHEM 9, Sheet 1). Go to Step (i).

R

(i) In hydraulics service center, check rigging to aileron limiter switch mechanism (Ref. 27-11-38). Is rigging correct?

Yes: Go to Step (j).

No: Adjust or repair rigging as necessary (Ref. 27-11-38).

(j) In hydraulic service center (zone 147, FS 1353), connect ohmmeter between 2711-TB2-5 terminal A and 2711-TB2-1 terminal A. Is resistance less than 10 ohms?

Yes: Check airplane wiring for open circuit (Ref. 22-13-00, SCHEM 9).

R

No: Replace aileron limiter switch mechanism (Ref. 27-11-38).

(k) From Step (h). Connect ohmmeter between roll computer No. 2 rack connector J4A-20 and pitch computer No. 2 rack connector J4A-03. Is resistance less than 10 ohms?

Yes: Go to Step (l).

No: Capt and F/O control wheel A/P DISC switch circuit open. Isolate to Capt or F/O control wheel or aircraft wiring using SCHEM 9 in 22-11-00 and wiring diagrams referenced.

R

(l) Connect ohmmeter between pitch computer No. 2 rack connector J4A-03 and J4A-55. Is resistance less than 500 ohms?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01).

No: Go to Step (m).

(m) Remove APFDS ENGAGE panel (Ref. 22-10-01), and disconnect 2211-P22 plug. Connect ohmmeter between APFDS ENGAGE panel connector J2-B and J2-ZH. Is resistance less than 500 ohms?

Yes: Check airplane wiring for open-circuit fault between APFDS ENGAGE panel cable 2211-P22-ZH and pitch computer No. 2 rack connector J4A-55 (Ref.
R 22-11-00, SCHEM 9).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(5) Fault: AP engage switch B will not hold in CWS

(a) In FESC, remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J2A-04 and ground. Is resistance less than 3.5 ohms?

Yes: Pitch computer 26 VAC power supply output
R shorted (Ref. 22-11-00, SCHEM 2). Leave ohmmeter connected and go to Step (b).

No: Go to Step (h).

(b) In FESC, pull ADC No. 2 out of rack to extent necessary to break electrical connection (Ref. 34-14-01). It is not necessary to disconnect pneumatic lines to the computer. Is resistance between pitch computer No. 2 rack connector J2A-04 and ground less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (c).

No: Replace ADC No. 2 (Ref. 34-14-01). Replace pitch computer No. 2 when fault is corrected (Ref. 22-11-01).

(c) In FESC, at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between pitch computer No. 2 rack connector J2A-04 and ground less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (d).

No: Go to Step (g).

(d) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between pitch computer No. 2 rack connector J2A-04 and ground less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (e).

No: Leave ohmmeter connected and go to Step (f).

R (e) In afterbody area, zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Is resistance between pitch computer No. 2 rack connector J2A-04 and ground less than 10 ohms?

R Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-11-07). Replace pitch computer No. 2 when fault is corrected (Ref. 22-11-01).

R No: Replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 2 (Ref. 22-11-01) when fault is corrected.

R (f) From Step (d). In Capt control wheel hub, disconnect 2711-P1 cable. In FESC at base of Capt control column, connect 2711-P11 cable. Is resistance between pitch computer No. 2 rack connector J2A-04 and ground less than 10 ohms?

R Yes: Check for short-to-ground fault in Capt control column (Ref. WDM 22-11-07). Replace pitch computer No. 2 when fault is corrected (Ref. 22-11-01).

R No: Replace Capt control wheel (Ref. 27-11-01). Replace pitch computer No. 2 when fault is corrected (Ref. 22-11-01).

R (g) From Step (c). In F/O control wheel hub, disconnect 2711-P2 cable. In FESC at base of Capt control column, connect 2711-P10 cable. Is resistance between pitch computer No. 2 rack connector J2A-04 and ground less than 10 ohms?

R Yes: Check for short-to-ground fault in F/O control column (Ref. WDM 22-11-07). Replace pitch computer No. 2 when fault is corrected (Ref. 22-11-01).

R No: Replace F/O control wheel (Ref. 27-11-01). Replace pitch computer No. 2 when fault is corrected (Ref. 22-11-01).

R (h) From Step (a). Replace pitch computer No. 2 (Ref. 22-11-01). On APFDS ENGAGE panel, will AP engage switch B hold in CWS.

R Yes: Fault condition in original computer.

R No: Go to Step (i).

(i) In FESC, remove roll computer No. 2 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 2 rack connector J2A-04 and ground. Is resistance less than 6 ohms?

Yes: Roll computer 26V ac power supply output
R shorted (Ref. 22-13-00, SCHEM 2). Leave ohmmeter connected and go to Step (j).

No: Go to Step (n).

(j) In FESC, remove compass coupler No. 2 (Ref. 34-22-03). Is resistance between roll computer No. 2 rack connector J2A-04 and ground less than 90 ohms?

Yes: Leave ohmmeter connected and go to Step (k).

No: Replace compass coupler No. 2 (Ref. 34-22-03). Replace roll computer No. 2 when fault
R is corrected (Ref. 22-02-01).

(k) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between roll computer No. 2 rack connector J2A-04 and ground less than 90 ohms?

Yes: Leave ohmmeter connected and go to Step (l).

No: Leave ohmmeter connected and go to Step (m).

(l) In left inboard wing area zone 551, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Is resistance between roll computer No. 2 rack connector J2A-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-13-01). Replace roll computer No. 2 when fault is corrected (Ref. 22-13-02).

No: Replace L inboard aileron servo control module (Ref. 27-11-17). Replace roll computer No. 2 when fault is corrected (Ref. 22-13-01).

(m) From Step (k). In F/O control wheel hub, disconnect 2711-P2 cable. In FESC at base of F/O control column connect 2711-P10 cable. Is resistance between roll computer No. 2 rack connector J2A-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in F/O control column (Ref. WDM 22-13-01). Replace roll computer No. 2 when fault is corrected (Ref. 22-13-01).

No: Replace F/O control wheel (Ref. 27-11-01). Replace roll computer No. 2 when fault is corrected (Ref. 22-13-01).

(n) From Step (i). Connect ohmmeter between roll computer No. 2 rack connector J2B-04 and ground. Is resistance less than 90 ohms?

Yes: Roll computer 26V ac power supply output shorted (Ref. 22-13-00, SCHEM 2). Leave ohmmeter connected and go to Step (o).

No: Go to Step (r).

(o) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between roll computer No. 2 rack connector J2B-04 and ground less than 90 ohms?

Yes: Leave ohmmeter connected and go to Step (p).

No: Leave ohmmeter connected and go to Step (q).

(p) In left inboard wing area zone 511, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Is resistance between roll computer No. 1 rack connector J2B-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-13-02). Replace roll computer No. 2 when fault is corrected (Ref. 22-13-01).

No: Replace L inboard aileron servo control module (Ref. 22-11-17). Replace roll computer No. 1 when fault is corrected (Ref. 22-13-01).

(q) From Step (o). In Capt control wheel hub, disconnect 2711-P1 cable. In FESC at base of Capt control column, connect 2711-P11 cable. Is resistance between roll computer No. 2 rack connector J2B-04 and ground less than 90 ohms?

Yes: Check for short-to-ground fault in Capt control column (Ref. WDM 22-13-02). Replace roll computer No. 2 when fault is corrected.

No: Replace Capt control wheel (Ref. 27-11-01). Replace roll computer No. 2 when fault is corrected (Ref. 22-13-01).

(r) From Step (n). Connect ohmmeter between roll computer No. 2 rack connectors J4A-03 and J2B-14. Is resistance more than 10 ohms?

Yes: Aileron authority limit switch No. 1 circuit open (Ref. 22-13-00, SCHEM 9). Go to Step (s). R

No: Go to Step (u).

(s) In hydraulic service center, check rigging to aileron authority limit mechanism (Ref. 27-11-38). Is rigging properly adjusted?

Yes: Go to Step (t).

No: Adjust rigging for proper switch operation (Ref. 27-11-38).

(t) In hydraulic service center (zone 147, FS 1353), connect ohmmeter between 2711-TB2-1 terminal B and 2711-TB1-1 terminal A. Is resistance more than 10 ohms?

Yes: Replace aileron authority limit switch No. 1 assembly (Ref. 27-11-38).

No: Check for open circuit in aircraft wiring (Ref. 22-13-00, SCHEM 9). R

(u) From Step (r). Replace roll computer No. 2 (Ref. 22-13-01). On APFDS ENGAGE panel, will AP engage switch B hold in CWS?

Yes: Fault condition in original computer.

No: Go to Step (v).

(v) On APFDS ENGAGE panel set AP engage switch B to CWS and hold in this position throughout following series of tests. Remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J2B-03 and ground. Is resistance more than 65 ohms?

Yes: Go to Step (w).

No: Go to Step (y).

(w) Remove APFDS ENGAGE panel and disconnect 2211-P22 cable from J2 on panel. Connect ohmmeter between 2211-P22-W on cable and ground. Is resistance more than 65 ohms?

Yes: Go to Step (x).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open circuit in
R airplane wiring (Ref. 22-11-00, SCHEM 9).

(x) In afterbody zone 317, disconnect 2741-P18 cable from J3 of stabilizer autopilot control servo. Connect ohmmeter between J3-08 and J3-23 on servo. Is resistance more than 65 ohms?

Yes: Replace hydraulic system A solenoid shutoff valve on stabilizer autopilot control servo (Ref. 22-11-07). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for open circuit in airplane wiring
R (Ref. 22-11-00, SCHEM 9).

(y) From Step (v). Is resistance less than 40 ohms?

Yes: Go to Step (z).

No: Go to Step (ah).

(z) Reverse ohmmeter leads and connect them between pitch computer No. 2 rack connector J2B-03 and ground. Is resistance less than 35 ohms?

Yes: Go to Step (aa).

No: Replace hydraulic system A solenoid shutoff valve (Ref. 22-11-05) on stabilizer autopilot control servo. Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

(aa) Remove APFDS ENGAGE panel and disconnect 2211-P22 from J2 on panel. Connect ohmmeter between 2211-P22-W on cable and ground. Is resistance less than 35 ohms?

Yes: Go to Step (ab).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for short to ground in
R airplane wiring (Ref. 22-11-00, SCHEM 9). Replace

pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

(ab) In afterbody zone 317, disconnect 2741-P18 cable from J3 of stabilizer autopilot control servo. Connect ohmmeter between J3-08 and J3-23 on servo. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A solenoid shutoff valve (Ref. 22-11-07). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 2 when fault has been corrected (Ref. 22-11-01).

No: Go to Step (ac).

(ac) Connect ohmmeter between J3-23 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A solenoid shutoff valve (Ref. 22-11-07) on stabilizer autopilot control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ad).

(ad) Connect ohmmeter between J3-18 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A pressurizing solenoid valve (Ref. 22-11-07) on autopilot stabilizer control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ae).

(ae) Connect ohmmeter between J3-20 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A high level override solenoid shutoff valve (Ref. 22-11-07) on stabilizer autopilot control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (af).

(af) In afterbody zone 317, disconnect 2741-P15 from J4 on stabilizer autopilot control servo. Connect ohmmeter between J4-09 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A engage and override warning pressure switch (Ref. 22-11-09) on stabilizer autopilot control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ag).

(ag) Connect ohmmeter between J4-12 on servo and ground. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A high level override force pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

R No: Check for short to ground in aircraft wiring (Ref. 22-11-00, SCHEM 9). Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

(ah) From Step (y). Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A solenoid shutoff valve (Ref. 22-11-07) on stabilizer autopilot control servo. Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ai).

(ai) Connect ohmmeter between pitch computer No. 2 rack connectors J2B-03 and J4B-66. Is resistance 50 (±15) ohms?

Yes: Leave ohmmeter connected and go to Step (an).

No: Leave ohmmeter connected and go to Step (aj).

(aj) Is resistance less than 35 ohms?

Yes: Leave ohmmeter connected and go to Step (ak).

No: Go to Step (al).

(ak) Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Go to Step (al).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open or short circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9). For short circuit fault replace pitch computer No. 2 (Ref. 22-11-01) when fault is corrected.

R

(al) From Steps (aj) and (ak). Remove APFDS ENGAGE panel and disconnect 2211-P22 from J2 on panel. Connect ohmmeter between 2211-P22-ZI and 2211-P22-P on cable. Is resistance 50 (±15) ohms?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open or short circuit in aircraft wiring (Ref. 22-11-00, SCHEM 9). For short circuit fault, replace pitch computer No. 2 (Ref. 22-11-01).

R
R

No: Go to Step (am).

(am) In afterbody zone 317, disconnect 2741-P18 cable from J3 of stabilizer autopilot control servo. Connect ohmmeter between J3-06 and J3-18 on servo. Is resistance 50 (±15) ohms?

Yes: Check for open or short circuit in aircraft wiring (Ref. 22-11-00, SCHEM 9). For short circuit fault, replace pitch computer No. 2 (Ref. 22-11-01).

R

No: Replace hydraulic system A engage and override warning pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05). For short circuit fault, replace pitch computer No. 2 (Ref. 22-11-01).

(an) From Step (ai). Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A pressure solenoid shutoff valve (Ref. 22-11-07). Replace pitch computer No. 2 (Ref. 22-11-01) when fault has been corrected.

No: Go to Step (ao).

(ao) Remove ohmmeter lead from pitch computer No. 2 rack connector J4B-66 and connect to pitch computer No. 2 rack connector J4A-18. Is resistance less than 35 ohms?

Yes: Replace hydraulic system A high level override pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Go to Step (ap).

(ap) In FESC, remove roll computer No. 2 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 2 rack connectors J2B-03 and J4A-49. Is resistance 50 (±15) ohms?

Yes: Go to Step (au).

No: Go to Step (aq).

(aq) Is resistance less than 35 ohms?

Yes: Go to Step (ar).

No: Go to Step (as).

(ar) Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Go to Step (as).

No: Replace avionic system No. 2 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. Replace roll computer No. 2 (Ref. 22-13-01) when fault has been corrected.

(as) From Steps (aq) and (ar). Remove APFDS ENGAGE panel and disconnect 2210-P22 from J2 on panel. Connect ohmmeter between 2210-P22-ZJ and 2210-P22-R on cable. Is resistance 50 (±15) ohms?

Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01). If problem persists, check for open or short
R circuit in aircraft wiring (Ref. 22-13-00, SCHEM
R 9). For short circuit fault, replace roll computer No. 2 when fault has been corrected (Ref. 22-13-01).

No: Go to Step (at).

(at) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Connect ohmmeter between J3-04 and J3-12 on servo. Is resistance 50 (±15) ohms?

Yes: Check for open or short circuit in aircraft
R wiring (Ref. 22-13-00 SCHEM 9). For short circuit fault, replace roll computer No. 2 (Ref. 22-13-01) when fault has been corrected.

No: Replace avionics system No. 2 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. If problem persists, replace L inboard aileron servo control module (Ref. 27-11-23). For short circuit fault, replace roll computer No. 2 (Ref. 22-13-01) when fault has been corrected.

(au) From step (ap). Reverse ohmmeter leads at ohmmeter. Is resistance less than 35 ohms?

Yes: Replace avionics system No. 2 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. Replace roll computer No. 2 (Ref. 22-13-01) when fault has been corrected.

No: Go to Step (av).

(av) Remove ohmmeter lead from roll computer No. 2 rack connector J4A-49 and connect to ground. Is resistance less than 500 ohms?

Yes: Go to Step (aw).

No: Go to Step (ay).

(aw) Remove APFDS ENGAGE panel and disconnect 2210-P22 from J2 on panel. Connect ohmmeter between 2210-P22-ZJ on cable and ground. Is resistance less than 500 ohms?

Yes: Go to Step (ax).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).
If problem persists, check for short to ground in
R aircraft wiring (Ref. 22-13-00, SCHEM 11).
Replace roll computer No. 2 when fault has been corrected (Ref. 22-13-01).

(ax) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 on L inboard aileron servo control module. Connect ohmmeter between J3-12 on servo and ground. Is resistance less than 500 ohms?

Yes: Replace avionics system No. 2 shutoff valve (Ref. 27-11-20) on L inboard aileron servo control module. If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17). Replace roll computer No. 2 when fault has been corrected (Ref. 22-13-01).

R No: Check for short to ground in aircraft wiring (Ref. 22-13-00, SCHEM 9). Replace roll computer No. 2 when fault has been corrected (Ref. 22-13-01).

(ay) From Step (av). Connect ohmmeter between roll computer No. 2 rack connector J4A-13 and ground. Is resistance less than 1500 ohms?

Yes: Go to Step (az).

No: Go to Step (ba).

(az) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 on L inboard aileron servo control module. Connect ohmmeter between J3-08 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace avionics system No. 2 pressure switch (Ref. 27-11-37).

R No: Check for short-to-ground fault in aircraft wiring (Ref. 22-13-00, SCHEM 9).

(ba) From Step (ay). On APFDS ENGAGE panel, release AP engage switch A to OFF. Connect ohmmeter between pitch computer No. 2 rack connector J2A-52 and J2A-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bc).

No: Go to Step (bb).

(bb) In afterbody zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Connect ohmmeter between J3-10 and J3-09 on servo. Is resistance 1000 (±200) ohms?

R Yes: Check for open or short circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 4).

No: Replace hydraulic system A EHV (avionics system No. 2) (Ref. 22-11-08). If problem

persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

(bc) From Step (ba). Remove ohmmeter lead from pitch computer No. 2 rack connector J2A-64 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (bd).

No: Go to Step (be).

(bd) In afterbody zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Connect ohmmeter between J3-09 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system A EHV (avionic system No. 2) (Ref. 22-11-08). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 4).

(be) From Step (bc). Connect ohmmeter between pitch computer No. 2 rack connector J2B-52 and J2B-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bg).

No: Go to Step (bf).

(bf) In afterbody zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Connect ohmmeter between J3-04 and J3-14 on servo. Is resistance 1000 (±200) ohms?

Yes: Check for open or short circuit fault in
R aircraft wiring (Ref. 22-11-00, SCHEM 4).

No: Replace hydraulic system A EHV (avionics system No. 2) (Ref. 22-11-08). If problem persists, stabilizer autopilot control servo (Ref. 22-11-05).

(bg) Does resistance noted in Step (be) differ from resistance noted in Step (ba) by more than 60 ohms?

Yes: Replace hydraulic system A EHV (avionic system No. 2) (Ref. 22-11-08).

No: Go to Step (bh).

(bh) Remove ohmmeter lead from pitch computer rack connector J2B-52 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (bi).

No: Go to Step (bj).

(bi) In afterbody zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Connect ohmmeter between J3-04 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system A EHV (avionics system No. 2) (Ref. 22-11-08). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

R No: Check for short-to-ground fault in aircraft wiring (Ref. 22-11-00, SCHEM 4).

(bj) From Step (bh). Connect ohmmeter between roll computer rack connector J2A-52 and J2A-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bl).

No: Go to Step (bk).

(bk) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Connect ohmmeter between J3-14 and J3-16 on servo. Is resistance 1000 (±200) ohms?

R Yes: Check for open or short-circuit fault in aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace hydraulic system A EHV (avionic system No. 2) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

(bl) From Step (bj). Remove ohmmeter lead from roll computer No. 2 rack connector J2A-64 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (bm).

No: Go to Step (bn).

(bm) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Connect ohmmeter between J3-16 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system A EHV (avionic system No. 2) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short-to-ground fault in aircraft wiring (Ref. 22-13-00, SCHEM 4).

R (bn) From Step (b1). Connect ohmmeter between roll computer No. 2 rack connector J2B-52 and J2B-64. Is resistance 1000 (±200) ohms?

Yes: Note resistance, leave ohmmeter connected, and go to Step (bp).

No: Go to Step (bo).

(bo) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Connect ohmmeter between J3-01 and J3-23. Is resistance 1000 (±200) ohms?

Yes: Check for open or short circuit fault in aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace hydraulic system A EHV (avionic system No. 2) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

(bp) From Step (bn). Does resistance noted in Step (bn) differ from resistance noted in Step (bj) by more than 60 ohms?

Yes: Replace hydraulic system A EHV (avionic system No. 2) (Ref. 27-11-21).

No: Go to Step (bq).

(bq) Remove ohmmeter lead from roll computer No. 2 rack connector J2B-64 and connect to ground. Is resistance less than 1500 ohms?

Yes: Go to Step (br).

No: Go to Step (bs).

(br) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Connect ohmmeter between J3-23 on servo and ground. Is resistance less than 1500 ohms?

Yes: Replace hydraulic system A EHV (avionic system No. 2) (Ref. 27-11-21). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short to ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 5).

(bs) From Step (bq). Connect ohmmeter between pitch computer No. 2 rack connector J2A-51 and J2A-63. Is resistance 250 (±50) ohms?

Yes: Leave ohmmeter connected and go to Step (bu).

No: Go to Step (bt).

(bt) In afterbody zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Connect ohmmeter between J3-19 and J3-21 on servo. Is resistance 250 (±50) ohms?

Yes: Check for open or short-circuit fault in
R aircraft wiring (Ref. 22-11-00, SCHEM 4).

No: Replace stabilizer autopilot control servo (Ref. 22-11-05).

(bu) From Step (bs). Remove ohmmeter lead from pitch computer No. 2 rack connector J2A-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (bv).

No: Go to Step (bw).

(bv) In afterbody zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Connect ohmmeter between J3-19 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 4).

(bw) From Step (bu). Connect ohmmeter between pitch computer No. 2 rack connector J2B-51 and J2B-63. Is resistance 250 (±50) ohms?

Yes: Leave ohmmeter connected and go to Step (by).

No: Go to Step (bx).

(bx) In afterbody zone 317, disconnect 2741-P18 cable from J3 on stabilizer autopilot control servo. Connect ohmmeter between J3-02 and J3-11 on servo. Is resistance 250 (±50) ohms?

Yes: Check for open or short circuit fault in
R aircraft wiring (Ref. 22-11-00, SCHEM 5).

No: Replace stabilizer autopilot control servo (Ref. 22-11-05).

(by) From Step (bw). Remove ohmmeter lead from pitch computer No. 2 rack connector J2B-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (bz).

No: Go to Step (ca).

(bz) In afterbody zone 317, disconnect 2741-P18 cable from J3 on autopilot stabilizer control servo. Connect ohmmeter between J3-11 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for short to ground fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 4).

(ca) From Step (by). Connect ohmmeter between roll computer No. 2 rack connector J2A-51 and J2A-63. Is resistance 160 (±40) ohms?

Yes: Leave ohmmeter connected and go to Step (cc).

No: Go to Step (cb).

(cb) In left inboard wing zone 511, disconnect 2711-P4 from J3 of L inboard aileron servo control module. Connect ohmmeter between J3-19 and J3-22 on servo. Is resistance 160 (±40) ohms?

Yes: Check for open or short-circuit fault in
R aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace L inboard aileron servo control module (Ref. 27-11-17).

(cc) From Step (ca). Remove ohmmeter lead from roll computer No. 2 rack connector J2A-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (cd).

No: Go to Step (ce).

(cd) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 on L inboard aileron servo control module. Connect ohmmeter between J3-19 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 5).

(ce) From Step (cc). Connect ohmmeter between roll computer No. 2 rack connector J2B-51 and J2B-63. Is resistance 160 (±40) ohms?

Yes: Leave ohmmeter connected and go to Step (cg).

No: Go to Step (cf).

(cf) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 of L inboard aileron servo control module. Connect ohmmeter between J3-02 and J3-03 on servo. Is resistance 160 (±40) ohms?

Yes: Check for open or short circuit fault in
R aircraft wiring (Ref. 22-13-00, SCHEM 4).

No: Replace L inboard aileron servo control module (Ref. 27-11-17).

(cg) From Step (ce). Remove ohmmeter lead from roll computer No. 2 rack connector J2B-63 and connect to ground. Is resistance less than 1000 ohms?

Yes: Go to Step (ch).

No: Go to Step (ci).

(ch) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 on L inboard aileron servo control module. Connect ohmmeter between J3-03 on servo and ground. Is resistance less than 1000 ohms?

Yes: Replace L inboard aileron servo control module (Ref. 27-11-17).

No: Check for short to ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 4).

(ci) From Step (cg). Install pitch computer No. 2 (Ref. 22-11-01). Install roll computer No. 2 (Ref. 22-13-01). Replace yaw computer No. 2 (Ref. 22-15-01). Establish original test conditions. On APFDS ENGAGE panel, will AP engage switch B remain in CWS?

Yes: Fault condition in original yaw computer.

No: Go to Step (cj).

WARNING: INCORRECT JUMPER CONNECTIONS MAY RESULT IN DAMAGE TO SYSTEM COMPONENTS.

(cj) Remove roll computer No. 2 (Ref. 22-13-01). On CB1, open AFCS MODE IND (B19) circuit breaker. On CB2, open AFCS WARNING - F/O (K19) circuit breaker. On roll computer No. 2 rack connectors, jumper J2B-06 to J2B-59, and jumper J4B-04 to J4A-45. Close B19 and K19 circuit breakers. On APFDS ENGAGE panel, will AP engage switch B remain in CWS?

Yes: Go to Step (ck).

No: Go to Step (cm).

(ck) In left inboard wing zone 511, disconnect 2711-P4 cable from J3 on L inboard aileron servo control module. On cable connector, jumper 2711-P4-05 to 2711-P4-08. Connect ohmmeter between roll computer No. 2 rack connector J4A-03 and J4A-13. Is resistance less than 10 ohms?

Yes: Leave ohmmeter connected and go to Step (cl).

No: Check for open-circuit fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 9).

(cl) Remove ohmmeter lead from J4A-03 and connect to ground. Is resistance less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft
R wiring (Ref. 22-13-00, SCHEM 9).

No: Replace avionics system No. 2 pressure switch (Ref. 27-11-37). If problem persists, replace avionics system No. 2 shutoff valve (Ref. 27-11-20). If problem persists, replace L inboard aileron servo control module (Ref. 27-11-17).

(cm) From Step (cj). In afterbody zone 317, disconnect 2741-P15 cable from J2 on stabilizer autopilot control servo. Connect ohmmeter between J2-01 and ground. Is resistance less than 500 ohms?

Yes: Replace hydraulic system A engage and override warning pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Go to Step (cn).

(cn) Connect ohmmeter between 2741-P15-01 on cable and ground. Is resistance less than 500 ohms?

Yes: Leave cable disconnected and go to Step (co).

No: Replace hydraulic system A engage solenoid shutoff valve (Ref. 22-11-07). If problem persists, replace hydraulic system A pressurizing solenoid shutoff valve (Ref. 22-11-07). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

(co) Temporarily identify pitch computers No. 1 and No. 2 and then remove both (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J4A-42 and ground. Is resistance less than 500 ohms?

Yes: Leave ohmmeter connected and go to Step (cp).

No: Replace pitch computer No. 1 (Ref. 22-11-01).

(cp) In FESC, remove trim augmentation computer (Ref. 22-18-01). Is resistance less than 500 ohms?

R Yes: Check for short-to-ground fault in aircraft wiring (Ref. 22-11-00, SCHEM 9, Sheet 2).

No: Replace trim augmentation computer (Ref. 22-18-01).

---

(6) Fault: AP LIMIT message is displayed

R (a) Set AP engage switch B to CMD. Depress VS switchlight to on. On same panel, rotate thumbwheel for VERT SPEED indication of +500 FPM. Does AP engage switch B drop to OFF?

Yes: Perform Steps (v) through (ao) of Fault (5) fault isolation procedure.

No: Go to Step (b).

(b) In FESC, remove pitch computer No. 1 (Ref. 22-11-01). Is AP LIMIT message displayed with AP engage switch B in CWS position?

Yes: Go to Step (c).

No: Replace pitch computer No. 1 (Ref. 22-11-01).

(c) Replace pitch computer No. 2 (Ref. 22-11-01). Is AP LIMIT message displayed with AP engage switch B in CWS.

Yes: Go to Step (d).

No: Original computer is faulted.

(d) Remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J4A-42 and ground. Is resistance more than 10 ohms?

Yes: Go to Step (e).

No: Go to Step (f).

(e) In afterbody zone 317, disconnect 2741-P15 cable from J4 on stabilizer autopilot control servo. Connect ohmmeter between J4-01 and J4-02 on servo. Is resistance more than 10 ohms?

Yes: Replace hydraulic system A engage and override warning pressure switch (Ref. 22-11-09) on stabilizer autopilot control servo. If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for open-circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9, Sheet 1).

(f) In afterbody zone 317, disconnect 2741-P15 and 2741-P18 cables from J4 and J3 on stabilizer autopilot control servo. Connect ohmmeter between 2741-P18-18 and 2741-P15-09 on cables. Is resistance less than 10 ohms?

Yes: Replace hydraulic system A engage and override warning pressure switch (Ref. 22-11-09). If problem persists, replace stabilizer autopilot control servo (Ref. 22-11-05).

No: Check for open circuit fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 9, Sheet 1).

---

(7) Fault: Control Column Position Changes

(a) In FESC, replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Does control column position change?

Yes: Go to Step (b).

No: Fault condition in original computer.

(b) In FESC, remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J2A-04 and J2A-24. Is resistance less than 5000 ohms?

Yes: Replace F/O control wheel (Ref. 27-11-01).

No: Go to Step (c).

(c) Connect ohmmeter between pitch computer No. 2 rack connectors J2A-04 and J2B-24. Is resistance less than 5000 ohms?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Replace F/O control wheel (Ref. 27-11-01). If problem persists, replace Capt control wheel (Ref. 27-11-01).

---

(8) Fault: Control wheel position changes

(a) Replace roll computer No. 2 (Ref. 22-13-01). Repeat test. Does control wheel position change?

R Yes: Go to Step (b).

R No: Fault condition in original computer.

R (b) Remove roll computer No. 2 (Ref. 22-13-01).
R Connect ohmmeter between roll computer No. 2 rack
R connector J2A-04 and J2A-25. Is resistance less
R than 5000 ohms?

R Yes: Replace F/O control wheel (Ref. 27-11-01).

R No: Go to Step (c).

R (c) Connect ohmmeter between roll computer No. 2 rack
R connector J2B-04 and J2B-25. Is resistance less
R than 5000 ohms?

R Yes: Replace F/O control wheel (Ref. 27-11-01).

R No: Replace Capt control wheel (Ref. 27-11-01).
R If problem persists, replace F/O control wheel
R (Ref. 27-11-01).

R ---

R (9) Fault: AP engage switch B drops to OFF

R (a) Close A6 circuit breaker. On APFDS ENGAGE panel,
R can AP engage switch A be set to CWS?

R Yes: Replace pitch computer No. 2 (Ref.
R 22-11-01).

R No: Replace trim augmentation computer (Ref.
R 22-18-01). If problem persists check for trim
R augmentation system fault (Ref. 22-18-00).

R ---

R (10) Fault: AP engage switch B remains in CWS

R (a) Remove pitch computer No. 1 (Ref. 22-11-01).
R Connect ohmmeter between pitch computer No. 2 rack
R connector J4A-03 and J4A-55. Depress and hold AP
R DISC switch on F/O control wheel. Is resistance
R less than 5000 ohms?

R Yes: Leave ohmmeter connected and go to Step (b).

R No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

(b) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J4A-03 and J4A-55 still less than 5000 ohms?

Yes: Check for short-circuit fault in aircraft
R wiring (Ref. 22-11-00, SCHEM 9).

No: Leave ohmmeter connected and go to Step (c).

(c) At base of F/O control column connect RH CONT WHL DISC 2711-P10. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J4A-03 and J4A-55 less than 5000 ohms?

Yes: Check for short-circuit in F/O control column wiring (Ref. WDM 22-11-07).

No: Replace F/O control wheel (Ref. 27-11-01).

---

(11) Fault: AP DISC message not displayed on one AFCS WARNING annunciator

(a) Can warning annunciator press-to-test (Ref. 22-12-01) be performed with no indicated faults?

Yes: Replace affected AFCS WARNING annunciator (Ref. 22-10-00). If problem persists check for open-circuit fault in aircraft wiring (Ref. 22-13-00, Fig. 111).

No: Perform warning annunciator fault isolation procedure (Ref. 22-12-00).

---

(12) Fault: Two-second aural warning does not sound

(a) Check for fault in aural warning system (Ref. 31-22-00).

---

(13) Fault: AP DISC messages not removed

(a) Is AP DISC message removed from one AFCS WARNING annunciator?

Yes: Replace annunciator which still displays AP DISC message (Ref. 22-10-06).

No: Go to Step (b).

(b) Replace roll computer No. 2 (Ref. 22-13-01). Repeat test. Are AP DISC messages removed?

Yes: Fault condition in original computer.

No: Replace roll computer No. 1 (Ref. 22-13-01).

---

(14) Fault: ALERT light not extinguished

(a) Replace annunciator which still displays ALERT light (Ref. 22-10-06).

R (15) Fault: AP engage switch B cannot be set to CMD.

R Perform fault isolation procedures for Fault (1)
R in 22-10-33, Page Block 101.

---

(16) Fault: AP engage switch B will not hold in CMD

(a) Replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(17) Fault: VS message not displayed

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

---

(18) Fault: AP engage switch B drops from CMD position

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

(19) Fault: AP engage switch B drops from CMD position

(a) Does switch drop to CWS position:

Yes: Perform FD vertical speed mode test (Ref. 22-12-11).

No: Perform fault isolation procedure for Fault (5).

---

(20) Fault: Control columns do not move

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

---

(21) Fault: Pitch trim wheels do not rotate

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Do pitch trim wheels rotate?

Yes: Fault condition in original computer.

No: Replace trim augmentation computer (Ref. 22-18-00). If problem persists check trim augmentation system for fault (Ref. 22-18-00).

---

(22) Fault: AP LIMIT message not displayed

(a) Is AP LIMIT message displayed on one AFCS WARNING indicator?

Yes: Replace AFCS WARNING indicator which does not display AP LIMIT message (Ref. 22-10-06). If problem persists, check for open-circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, in afterbody zone 317, replace hydraulic system A engage and override warning pressure switch (Ref. 22-11-09).

---

(23) Fault: AP engage switch B remains in CMD

(a) Remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J4A-03 and J4A-55. Depress and hold AP DISC switch on Capt control wheel. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (b).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

(b) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J4A-03 and J4A-55 less than 5000 ohms?

Yes: Check for short circuit fault in aircraft wiring (Ref. 22-11-00, SCHEM 9).

No: Leave ohmmeter connected and go to Step (c).

(c) At base of Capt control column, connect LH CONT WHL DISC 2711-P11. In Capt control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J4A-03 and J4A-55 less than 5000 ohms?

Yes: Check for short circuit in Capt control column wiring (Ref. WDM 22-11-08).

No: Replace Capt control wheel.

---

(24) Fault: VS message not removed

(a) Perform FD vertical speed mode test (Ref. 22-12-11).

---

(25) Fault: AP LIMIT messages not removed

(a) Is AP LIMIT message removed from one AFCS WARNING annunciator?

Yes: Replace AFCS WARNING annunciator which still displays AP LIMIT message (Ref. 22-10-06).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

---

(26) Fault: Flashing ALERT light not extinguished

(a) Is ALERT light extinguished on F/O annunciator?

Yes: Replace Capt annunciator (Ref. 22-10-06). If problem persists, check for open-circuit fault in aircraft wiring (Ref. 22-00-00, SCHEM 4).

No: Replace F/O annunciator (Ref. 22-10-06).

---

(27) Fault: AP DISC message not removed

(a) Is AP DISC message removed on F/O annunciator?

Yes: Replace Capt annunciator (Ref. 22-10-06).

No: Replace F/O annunciator (Ref. 22-10-06).

---

(28) Fault: HDG SEL message not displayed

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(29) Fault: AP engage switch B drops from CMD position

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(30) Fault: AP engage switch B drops from CMD position

(a) Does switch drop to CWS position?

Yes: Perform FD heading select mode test (Ref. 22-13-31).

No: Perform fault isolation for Fault (5).

---

(31) Fault: Control wheels to not rotate

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(32) Fault: AP engage switch B does not drop to OFF

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Does switch drop to OFF?

Yes: Fault condition in original computer.

No: Replace trim augmentation computer (Ref 22-18-01). If problem persists, check trim augmentation system for fault (Ref. 22-18-00).

---

(33) Fault: HDG SEL message is not removed

(a) Perform FD heading select mode test (Ref. 22-13-31).

---

(34) Fault: AP DISC message not removed

(a) Replace roll computer No. 2 (Ref. 22-13-01). Repeat test. Are AP DISC messages removed?

Yes: Fault condition in original computer.

No: Replace roll computer No. 1 (Ref. 22-13-01).

---

(35) Fault: Pitch trim wheels rotate

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Do pitch trim wheels rotate?

Yes: Replace trim augmentation computer (Ref. 22-18-01).

No: Fault condition in original computer.

---

(36) Fault: AP engage switch B drops to OFF

(a) Perform FD altitude hold mode test (Ref. 22-11-33).

---

(37) Fault: ALT message not displayed

(a) Perform FD altitude hold mode test (Ref. 22-11-33).

---

(38) Fault: ALT message not removed

(a) Replace pitch computer No. 2 (Ref. 22-11-01) and repeat test. On F/O AFCS MODES annunciator is ALT message removed?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J2A-24 and J2A-36. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (c).

No: Leave ohmmeter connected and go to Step (e).

(c) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Connect jumper between 2711-J10-43 and 2711-J10-42. Is resistance between rack connector J2A-24 and J2A-36 still more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-11-04).

No: Leave ohmmeter connected and go to Step (d).

(d) Remove jumper from 2711-J10 connector and connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Connect jumper between 2711-P2-35 and 2711-P2-19 on cable. Is resistance between rack connector J2A-24 and J2A-36 more than 160 ohms?

Yes: Check for open-circuit fault in F/O control column wiring (Ref. WDM 22-11-04).

No: Replace F/O control wheel (Ref. 27-11-01).

(e) From Step (b). Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (f).

No: Leave ohmmeter connected and go to Step (h).

(f) In FESC at base of F/O control column disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J2A-24 and J2A-36 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-11-04).

No: Leave ohmmeter connected and go to Step (g).

(g) Connect 2711-P2 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J2A-24 and J2A-36 less than 80 ohms?

Yes: Check for short-circuit fault in F/O control column wiring (Ref. WDM 22-11-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(h) From Step (e). Remove ohmmeter lead from rack connector J2A-36 and connect to ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (i).

No: Go to Step (k).

(i) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J2A-24 and ground still less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-11-04).

No: Leave ohmmeter connected and go to Step (j).

(j) Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J2A-24 and ground still less than 5000 ohms?

Yes: Check for short-to-ground fault in F/O control column wiring (Ref. WDM 22-11-03).

No: Replace F/O control wheel (Ref. 27-11-01).

(k) From Step (h). In FESC, partially remove air data computer No. 2 to the extent necessary to break electrical connection (Ref. 34-14-01). It is not necessary to break pneumatic connections. Connect ohmmeter between pitch computer No. 2 rack connector J2A-04 and ground. Is resistance more than 15 ohms?

Yes: Leave ohmmeter connected and go to Step (i).

No: Replace Capt control wheel (Ref. 27-11-01).

(l) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Connect jumper between 2711-J10-16 and 2711-J10-3. Is resistance between rack connector J2A-04 and ground more than 10 ohms?

Yes: Check aircraft wiring for open-circuit fault (Ref. WDM 22-11-08).

No: Leave ohmmeter connected and go to Step (m).

(m) Remove jumper from 2711-J10. Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Connect jumper between 2711-P2-36 and 2711-P2-2 on cable. Is resistance between rack connector J2A-04 and ground more than 10 ohms?

Yes: Check F/O control column wiring for open-circuit fault (Ref. WDM 22-11-08).

No: Replace F/O control wheel (Ref. 27-11-01).

---

(39) Fault: Pitch trim wheels do not rotate

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Do pitch trim wheels rotate?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Replace trim augmentation computer (Ref. 22-18-01). Do pitch trim wheels rotate?

Yes: Fault condition in original computer.

No: Check for trim augmentation system fault (Ref. 22-18-00).

---

(40) Fault: ALT message not removed

(a) Replace pitch computer No. 2 (Ref. 22-11-01) and repeat test. Is ALT message removed?

Yes: Fault condition in original computer.

No: Replace F/O control wheel (Ref. 27-11-01).

---

(41) Fault: ALT message not removed

(a) Replace pitch computer No. 2 (Ref. 22-11-01) and repeat test. On F/O AFCS MODES annunciator is ALT message removed?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Remove pitch computer No. 2 (Ref. 22-11-01). Connect ohmmeter between pitch computer No. 2 rack connector J2B-24 and J2B-36. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (c).

No: Leave ohmmeter connected and go to Step (e).

(c) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Connect jumper between 2711-J11-36 and 2711-J11-37. Is resistance between rack connector J2B-24 and J2B-36 more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-11-03).

No: Leave ohmmeter connected and go to Step (d).

(d) Remove jumper from 2711-J11 connector. Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-2 and 2711-P1-22 on cable. Is resistance between rack connector J2B-24 and J2B-36 more than 160 ohms?

Yes: Check for open-circuit fault in Capt control column (Ref. WDM 22-11-04).

No: Replace Capt control wheel (Ref. 27-11-01).

(e) From Step (b). Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (f).

No: Leave ohmmeter connected and go to Step (h).

(f) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J2B-24 and J2B-36 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-11-04).

No: Leave ohmmeter connected and go to Step (g).

(g) Connect 2711-P10 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J2B-24 and J2B-36 less than 80 ohms?

Yes: Check for short-circuit fault in Capt control column wiring (Ref. WDM 22-11-04).

No: Replace Capt control wheel (Ref. 27-11-01).

(h) From Step (e). Connect ohmmeter between pitch computer No. 2 rack connector J2B-24 and ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (i).

No: Go to Step (k).

(i) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J2B-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-11-04).

No: Leave ohmmeter connected and go to Step (j).

(j) Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J2B-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in Capt control column wiring (Ref. 22-11-03).

No: Replace Capt control wheel (Ref. 27-11-01).

(k) From Step (h). In FESC, partially remove air data computer No. 2 to the extent necessary to break electrical connection (Ref. 34-14-01). It is not necessary to break pneumatic connections. Connect

ohmmeter between pitch computer No. 2 rack connector J2A-04 and ground. Is resistance more than 15 ohms?

Yes: Leave ohmmeter connected and go to Step (l).

No: Replace Capt control wheel (Ref. 27-11-01).

(l) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Connect jumper between 2711-J10-12 and 2711-J10-02 on cable. Is resistance between rack connector J2B-04 and ground still more than 10 ohms?

Yes: Check aircraft wiring for open-circuit fault (Ref. WDM 22-11-07).

No: Leave ohmmeter connected and go to Step (m).

(m) Remove jumper from 2711-J11. Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-21 and 2711-P1-10 on cable. Is resistance between rack connector J2B-04 and ground more than 10 ohms?

Yes: Check Capt control column wiring for open-circuit fault (Ref. WDM 22-11-07).

No: Replace F/O control wheel (Ref. 27-11-01).

---

(42) Fault: ALT message not removed

(a) Replace pitch computer No. 2 (Ref. 22-11-01) and repeat test. Is ALT message removed?

Yes: Fault condition in original computer.

No: Replace Capt control wheel (Ref. 27-11-01).

---

(43) Fault: AP engage switch B does not drop to OFF

(a) Replace roll computer No. 2 (Ref. 22-13-01). Repeat test. Does switch drop to OFF?

Yes: Fault condition in original computer.

No: Replace pitch computer No. 2 (Ref. 22-11-01).

(44) Fault: YAW SAS 2 switchlight FAIL legend not illuminated

(a) Check for yaw stability augmentation system fault (Ref. 22-15-00).

(45) Fault: Control wheel forces not equal

(a) Replace roll computer No. 2 (Ref. 22-11-01). Repeat test. Are forces approximately equal?

Yes: Fault condition in original computer.

No: Go to Step (b).

(b) Is F/O control wheel force greater?

Yes: Go to Step (c).

No: Go to Step (o).

(c) Remove roll computer No. 2 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 2 rack connector J2A-25 and J2A-37. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (d).

No: Leave ohmmeter connected and go to Step (f).

(d) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Connect jumper between 2711-J10-40 and 2711-J10-41. Is resistance between rack connector J2A-25 and J2A-37 more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-13-04).

No: Leave ohmmeter connected and go to Step (e).

(e) Remove jumper from 2711-J10. Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P10 cable. Connect jumper between 2711-P2-18 and 2711-P2-38 on cable. Is resistance between rack connector J2A-25 and J2A-37 still more than 160 ohms?

Yes: Check for open-circuit fault in F/O control column wiring (Ref. WDM 22-13-04).

No: Replace F/O control wheel (Ref. 27-11-01).

(f) From Step (c). Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (g).

No: Leave ohmmeter connected and go to Step (i).

(g) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J2A-25 and J2A-37 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-13-04).

No: Leave ohmmeter connected and go to Step (h).

(h) Connect 2711-P2 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between rack connector J2A-25 and J2A-37 less than 80 ohms?

Yes: Check for short-circuit fault in F/O control column wiring (Ref. WDM 22-13-04).

No: Replace F/O control wheel (Ref. 27-11-01).

(i) From Step (f). Connect ohmmeter between roll computer No. 2 rack connector J2A-25 and ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (j).

No: Go to Step (l).

(j) In FESC at base of F/O control column, disconnect RH CONT WHL DISC 2711-P10. Is resistance between rack connector J2A-25 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-13-04).

No: Leave ohmmeter connected and go to Step (k).

(k) Connect 2711-P10 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Is resistance between

rack connector J2A-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in F/O control column wiring (Ref. WDM 22-13-04).

No: Replace F/O control wheel (Ref. 27-11-01).

(l) From Step (i). In FESC, remove compass coupler No. 2 (Ref. 34-22-06). Connect ohmmeter between roll computer No. 2 rack connector J2A-04 and ground. Is resistance more than 70 ohms?

Yes: Leave ohmmeter connected and go to Step (m).

No: Replace F/O control wheel (Ref. 27-11-01).

(m) In FESC at base of F/O control column, disconnect 2711-P10 cable. Connect jumper between 2711-J10-17 and 2711-J10-4. Is resistance between rack connector J2A-04 and ground more than 10 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-13-02).

No: Leave ohmmeter connected and go to Step (n).

(n) Remove jumper from 2711-J11. Connect 2711-P11 cable. In F/O control wheel hub, disconnect 2711-P2 cable. Connect jumper between 2711-P2-37 and 2711-P2-39 on cable. Is resistance between rack connector J2A-04 and ground more than 10 ohms?

Yes: Check Capt control column wiring for open-circuit fault (Ref. WDM 22-13-02).

No: Replace F/O control wheel (Ref. 27-11-01).

(o) From Step (b). Remove roll computer No. 2 (Ref. 22-13-01). Connect ohmmeter between roll computer No. 2 rack connector J2B-25 and J2B-37. Is resistance more than 160 ohms?

Yes: Leave ohmmeter connected and go to Step (p).

No: Leave ohmmeter connected and go to Step (r).

(p) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Connect jumper between 2711-J11-38 and 2711-J11-39 on cable. Is

resistance between rack connector J2B-25 and J2B-37 more than 160 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-13-04).

No: Leave ohmmeter connected and go to Step (g).

(q) Remove jumper 2711-J11 connector. Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-9 and 2711-P1-41 on cable. Is resistance between rack connector J2B-25 and J2B-37 more than 160 ohms?

Yes: Check for open-circuit fault in Capt control column wiring (Ref. WDM 22-13-04).

No: Replace Capt control wheel (Ref. 27-11-01).

(r) Is resistance less than 80 ohms?

Yes: Leave ohmmeter connected and go to Step (s).

No: Leave ohmmeter connected and go to Step (u).

(s) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J2B-25 and J2B-37 less than 80 ohms?

Yes: Check for short-circuit fault in aircraft wiring (Ref. WDM 22-13-04).

No: Leave ohmmeter connected and go to Step (t).

(t) Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J2B-25 and J2B-37 less than 80 ohms?

Yes: Check for short-circuit fault in Capt control column wiring (Ref. WDM 22-13-04).

No: Replace Capt control wheel (Ref. 27-11-01).

(u) From Step (r). Connect ohmmeter between roll computer No. 2 rack connector J2B-25 and ground. Is resistance less than 5000 ohms?

Yes: Leave ohmmeter connected and go to Step (v).

No: Go to Step (x).

(v) In FESC at base of Capt control column, disconnect LH CONT WHL DISC 2711-P11. Is resistance between rack connector J2B-25 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in aircraft wiring (Ref. WDM 22-13-04).

No: Leave ohmmeter connected and go to Step (v).

(w) Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Is resistance between rack connector J2B-24 and ground less than 5000 ohms?

Yes: Check for short-to-ground fault in Capt control column wiring (Ref. WDM 22-13-04).

No: Replace Capt control wheel (Ref. 27-11-01).

(x) From Step (u). Connect ohmmeter between roll computer No. 2 rack connector J2B-04 and ground. Is resistance more than 70 ohms?

Yes: Leave ohmmeter connected and go to Step (y).

No: Replace Capt control wheel (Ref. 27-11-01).

(y) In FESC at base of F/O control column, disconnect LH CONT WHL DISC 2711-P11. Connect jumper between 2711-J11-38 and 2711-J11-39. Is resistance between rack connector J2B-04 and ground more than 10 ohms?

Yes: Check for open-circuit fault in aircraft wiring (Ref. WDM 22-13-04).

No: Leave ohmmeter connected and go to Step (z).

(z) Remove jumper from 2711-J11. Connect 2711-P11 cable. In Capt control wheel hub, disconnect 2711-P1 cable. Connect jumper between 2711-P1-9 and 2711-P1-41 on cable. Is resistance between rack connector J2B-04 and ground more than 10 ohms?

Yes: Check Capt control column wiring for open-circuit fault (Ref. WDM 22-13-04).

No: Replace Capt control wheel (Ref. 27-11-01).

(46) Fault: Control wheel forces not equal

(a) Replace roll computer No. 2 (Ref. 22-13-01). Repeat test. Are forces approximately equal?

Yes: Fault condition in original computer.

No: Replace high-force control wheel (Ref. 27-11-01).

---

(47) Fault: AP engage switch B remains in CWS

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Does AP engage switch B drop to OFF?

Yes: Fault condition in original computer.

No: Replace roll computer No. 1 (Ref. 22-13-01).

AUTOPILOT - FLIGHT DIRECTOR PITCH SYSTEM - DESCRIPTION AND OPERATION

1. General

R The autopilot flight director (APFD) pitch system provides single-channel fail-soft cruise modes, and dual-dual channel fail-operational AUTOLAND track pitch axis commands for the AFCS. The APFD pitch system provides pitch servo drive and flight director drive as basic outputs.

The APFD pitch system is comprised of the following components (Ref. Fig. 1):

22-10-01 APFDS ENGAGE Panel

22-10-02 NAV MODE Panel

22-10-03 HDG/PITCH Mode Panel

22-10-05 AFCS Modes Annunciator

22-10-06 AFCS WARNING Indicator

22-10-11 AFCS/MLG Accessory Unit

22-11-01 Pitch Computer

22-11-02 Normal Accelerometer

22-11-03 Altitude Select Panel

22-11-05 Stabilizer Autopilot Control Servo

In addition to the APFD pitch system components, the system uses inputs from other aircraft systems (Ref. Fig. 2). Paragraph 13 lists the APFD pitch system interface with other systems.

2. Operation

A. Power Application

Power application to the APFD pitch system is described in Section 22-12-00.

B. Common Modes of Operation

Pitch modes of operation that are common with roll modes of operation are described in Section 22-12-00.

C. Pitch Axis Modes of Operation

The pitch axis operating modes are engaged automatically through APFDS engagement or by manual selection on the flight station glareshield control panels. The following pitch axis modes are available:

Pitch attitude hold

Altitude hold

Control wheel steering

Mach hold

Indicated airspeed hold

Indicated airspeed hold

Vertical speed

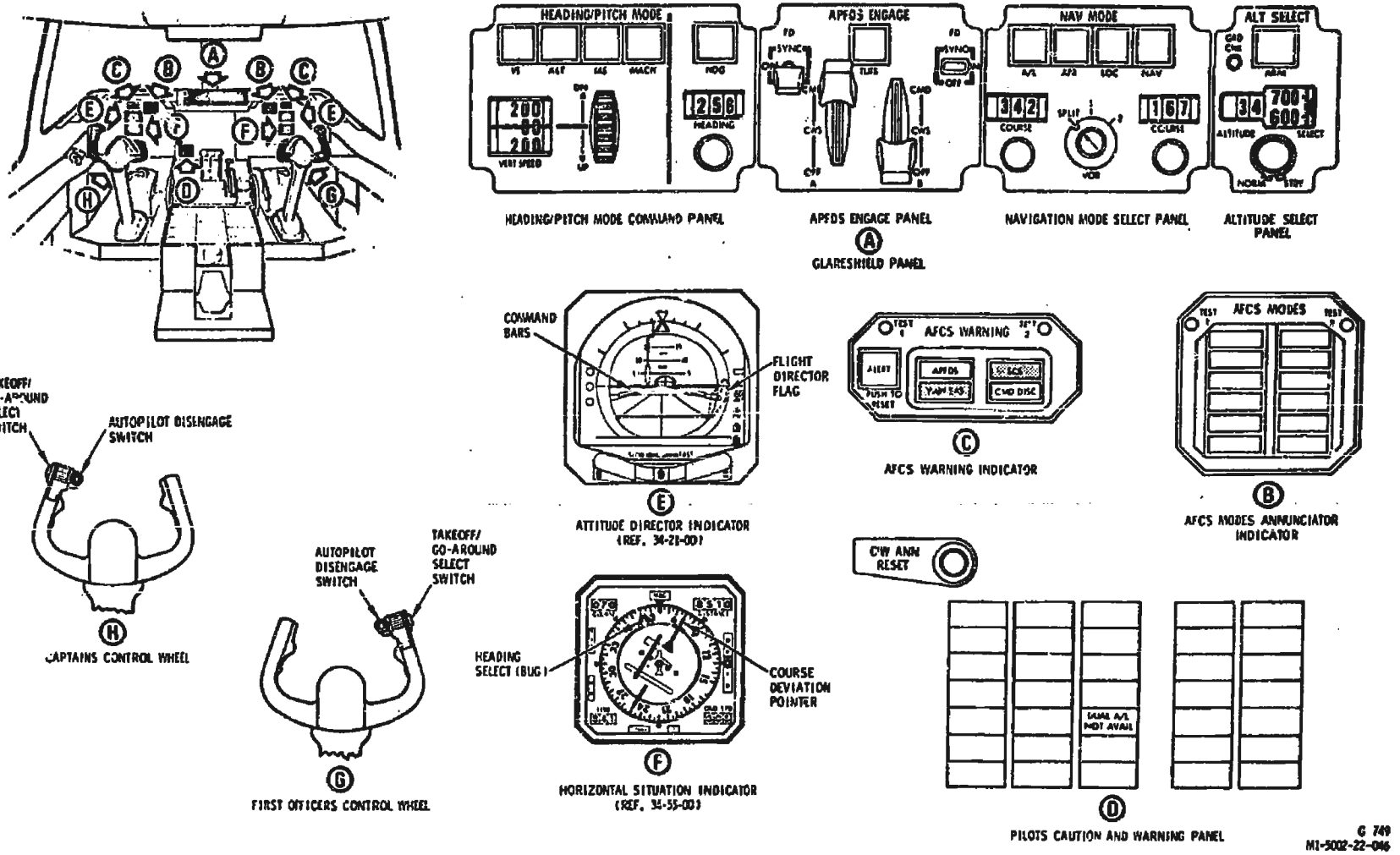
Altitude select

The pitch command signals computed for the autopilot pitch modes of operation (Ref. Fig. 3) are applied to the electro-hydraulic servo valve coils in the respective channels of the dual stabilizer autopilot servo (Ref. 27-41-00). The servo valve converts the pitch command signals into proportional hydraulic pressure to control servo actuator movement. The servo actuator then drives the stabilizer servo through linkage, resulting in stabilizer movement. A dual autopilot position LVDT (linear variable differential transducer) in each stabilizer autopilot servo channel picks off the servo actuator displacement and feeds back proportional position signals to the associated pitch computer servo amplifiers. The feedback signals oppose and partially cancel the pitch command signals to the servo amplifiers.

The pitch command signal from the pitch computer is applied to the associated attitude director indicator to drive the pitch command bar.

(1) Pitch Attitude Hold

The pitch attitude hold mode (Ref. Fig. 4) is established when either autopilot is engaged in the basic or command configuration, and/or when either or both flight directors are engaged with no other pitch axis control mode engaged. Engagement at attitudes exceeding the maximum pitch attitude limits results in



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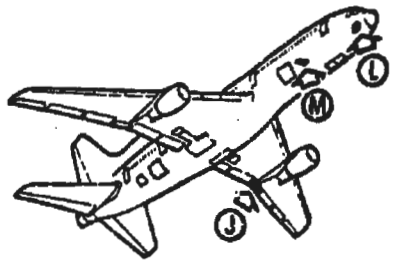
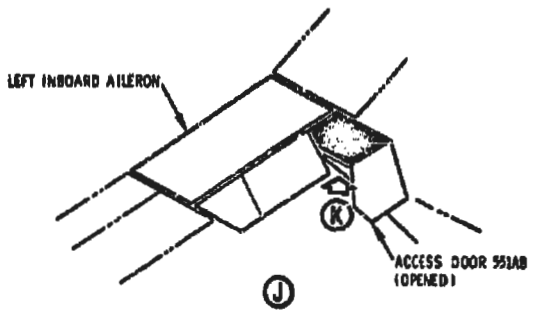
R APFDS Pitch System Equipment and Location
R Figure 1 (Sheet 1)

R EFFECTIVITY: ALL
R
0508





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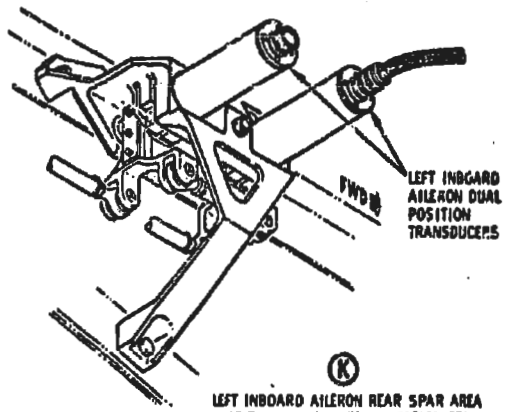
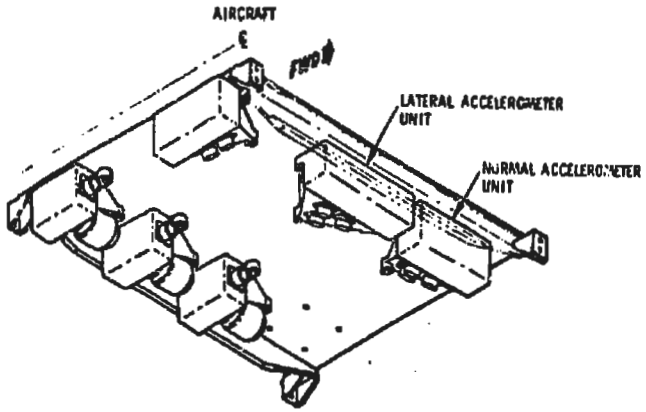
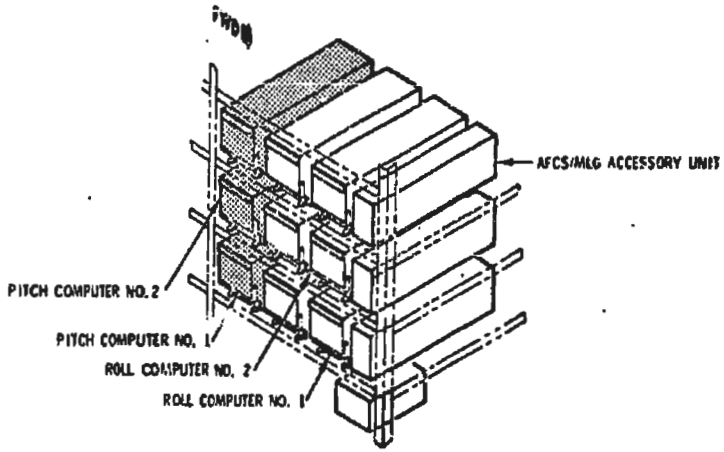


K
LEFT INBOARD AILERON REAR SPAR AREA
(LEFT INBOARD AILERON STATION 57)



M
ABOVE GALLEY CEILING
(LOOKING UP)



L
FORWARD ELECTRONIC SERVICE CENTER
CENTER RACK

C 746
M1-0102-22-080

R APFDS Pitch System Equipment and Location
R Figure 1 (Sheet 2)

R EFFECTIVITY: ALL
R
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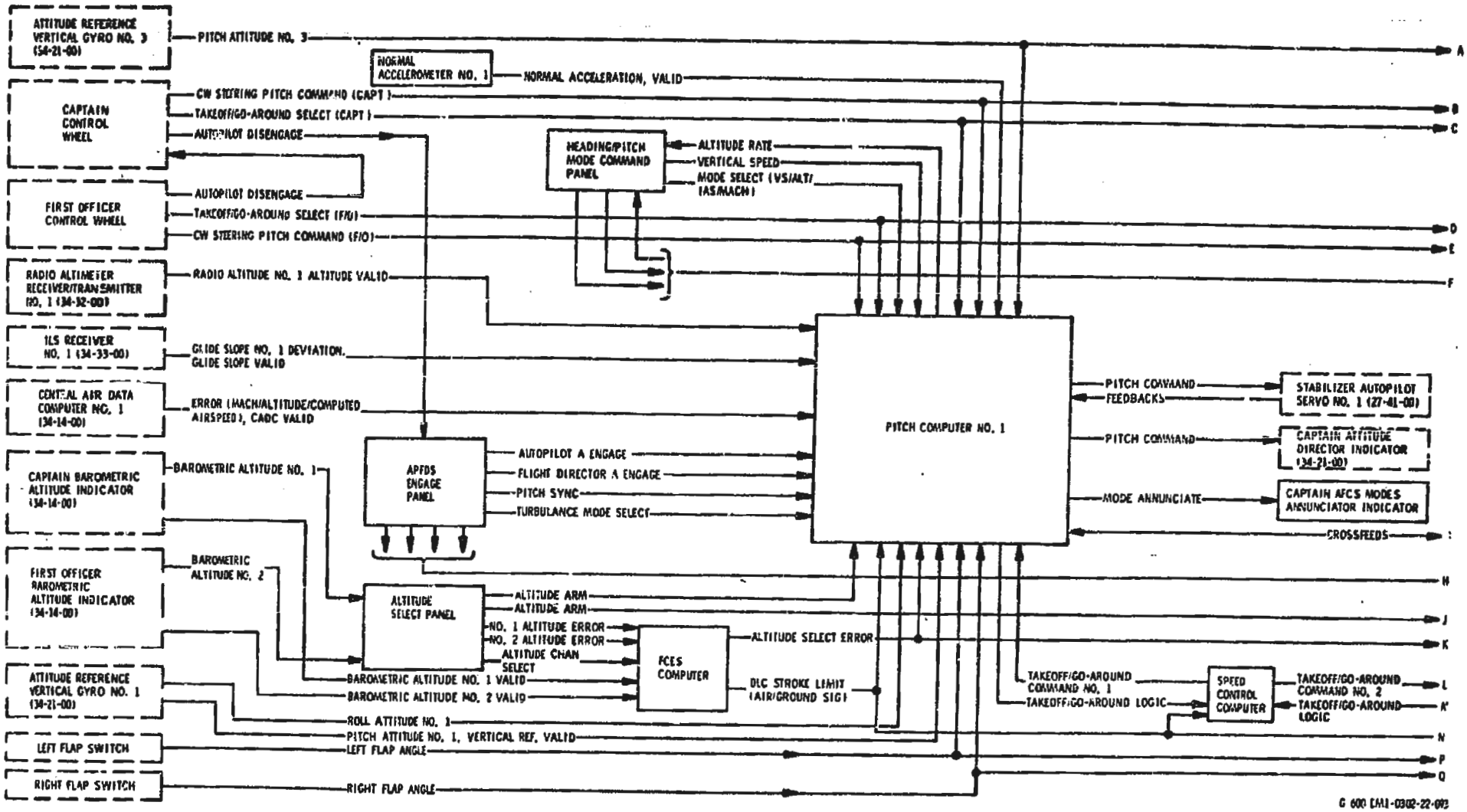

R APFDS Pitch Channel, Interface Block Diagram
R Figure 2 (Sheet 1)

R EFFECTIVITY: ALL
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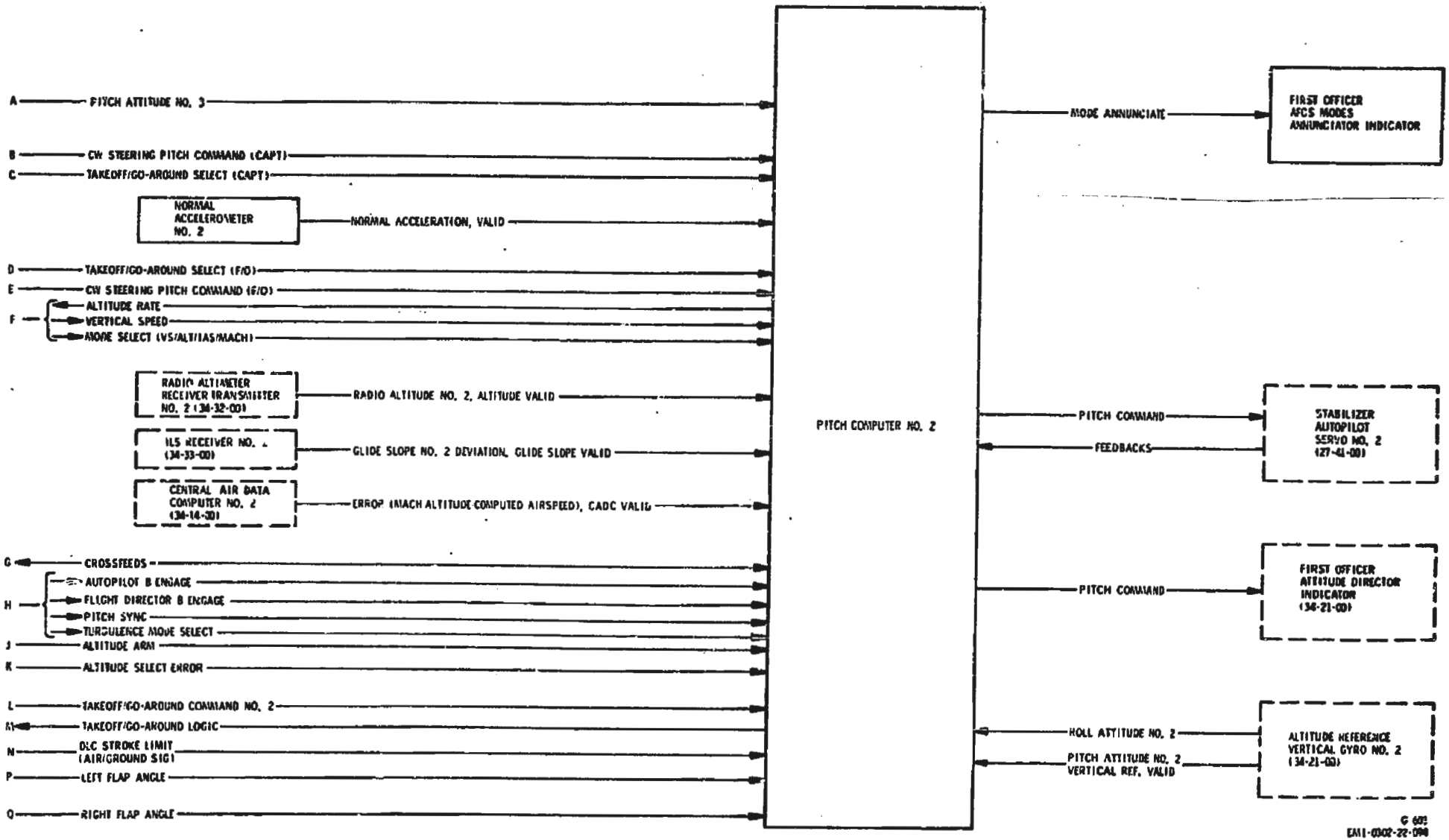

R APFDS Pitch Channel Interface Block Diagram
R Figure 2 (Sheet 2)

R EFFECTIVITY: ALL
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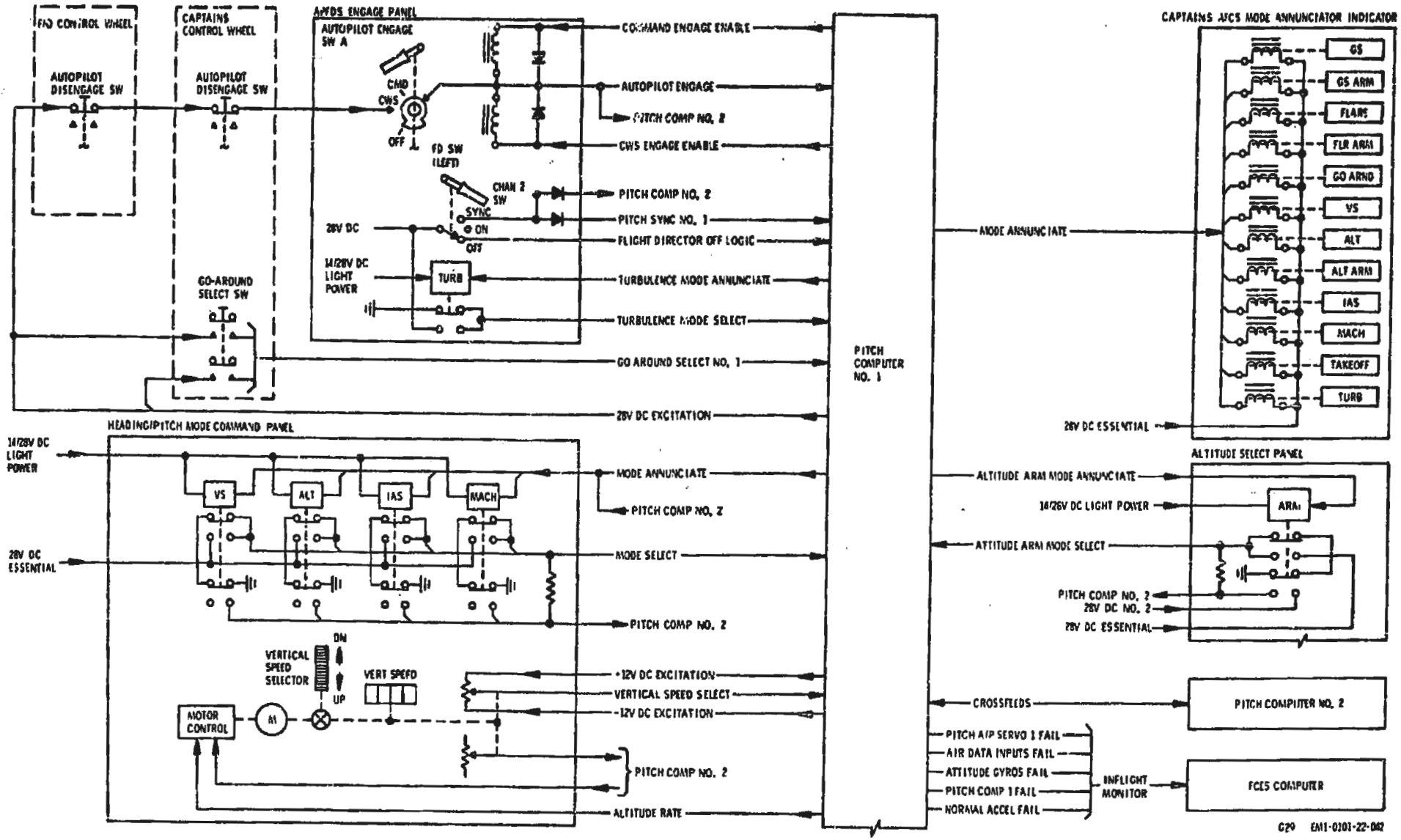

Pitch Channel Functional Block Diagram
Figure 3 (Sheet 1)

EFFECTIVITY: ALL

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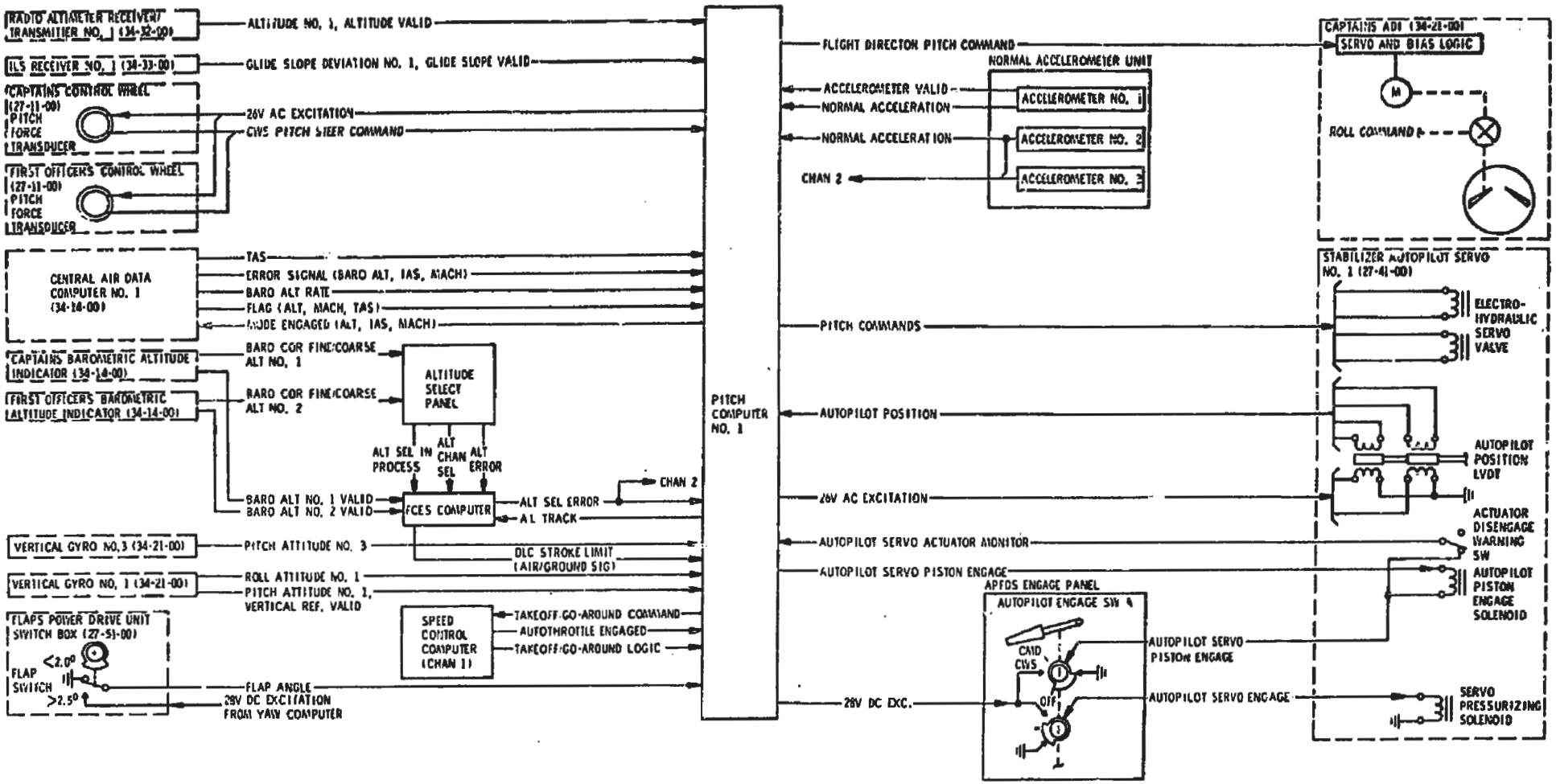

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Pitch Channel Functional Block Diagram
Figure 3 (Sheet 2)

EFFECTIVITY: ALL

0508

a command to revert to and maintain the maximum pitch attitude.

With the autopilot engaged in the basic configuration, control wheel steering is available to establish a new autopilot pitch attitude reference. After flying to a new attitude and releasing the force on the control wheel, the autopilot synchronizes to and maintains new attitude. The mode command signal is limited to ±5 degrees and rate is limited to ±1 degree per second with flaps up and ±5 degrees per second with flaps down. The pitch attitude information from the inertial units/vertical gyros forms the basic control signal in the pitch attitude hold mode. A rate signal is derived by feeding the attitude signal through a differentiation network. The synchronizer is locked during autopilot engagement. Any deviation of the aircraft from the engaged pitch attitude will result in a command signal being generated to restore the aircraft to the engaged pitch attitude.

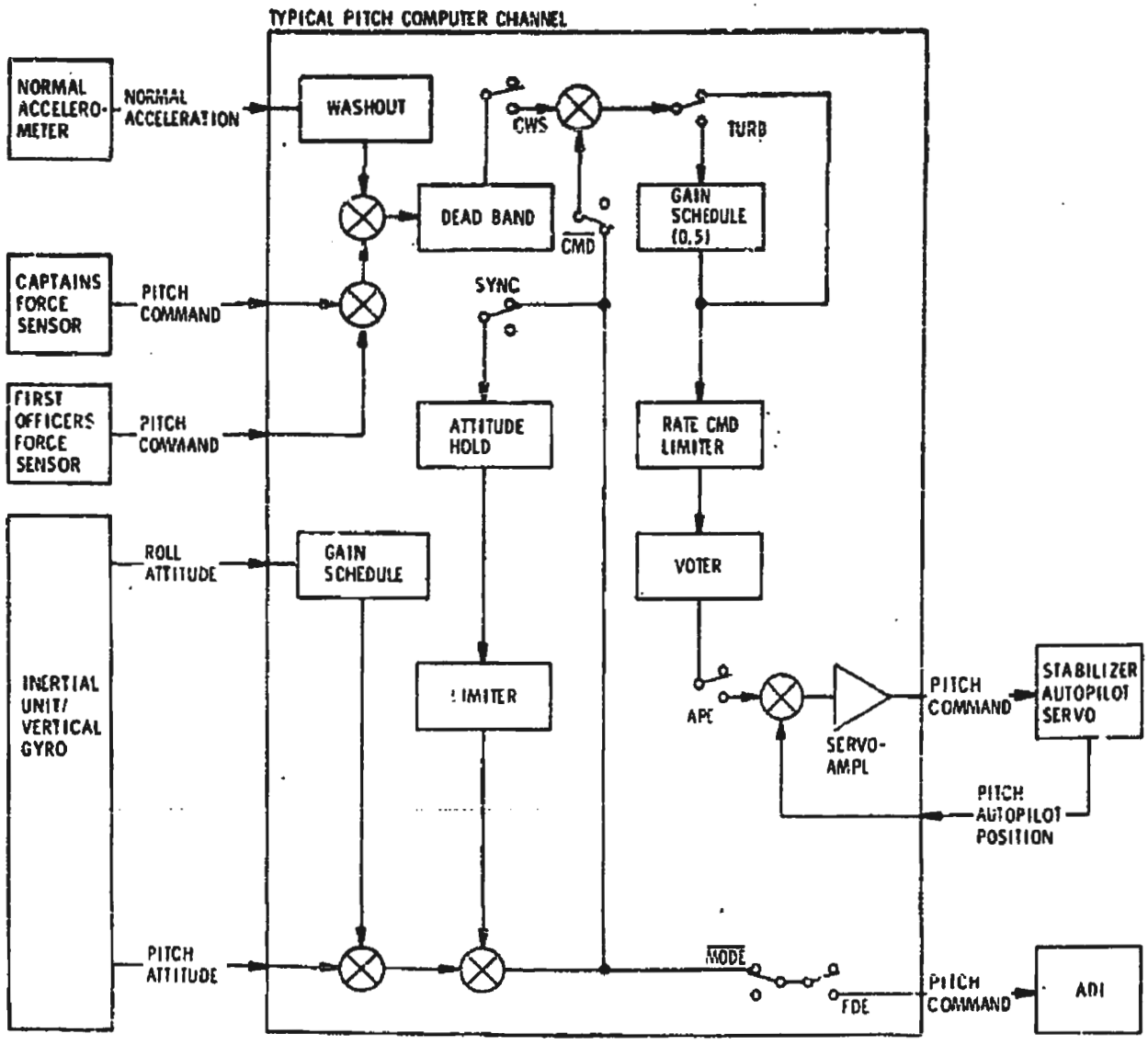
When either or both flight directors are engaged with the autopilot disengaged, a new pitch attitude reference can be established by manually controlling the aircraft to the new pitch attitude and momentarily placing either flight director (FD) switch to the SYNC position. The pitch command bars on both attitude director indicators are centered and thereafter display commands to maintain the new attitude reference.

(2) Altitude Hold

The altitude hold mode (Ref. Fig. 5) may be engaged with either autopilot in CWS or CMD, and/or at least one FD on. The mode also engages with autocapture by altitude select system. The mode is engaged by depressing the ALT switchlight on the HEADING/PITCH MODE command panel.

The ALT mode engages if the turbulence (TURB) mode and the approach (APR) or AUTOLAND (A/L) mode are not engaged. The mode engagement illuminates the ALT switchlight and causes the AFCS MODES indicators to annunciate the ALT mode.

When the ALT mode is selected, an altitude hold engage signal is sent to the airdata computer (ADC) (Ref. 34-14-00) to clutch in an altitude hold synchro. The ALT mode engages if the true airspeed and altitude data are valid. The CADC contains an altitude-sensing function and a synchronization system which monitors all altitude changes before the altitude hold mode



LEGEND:

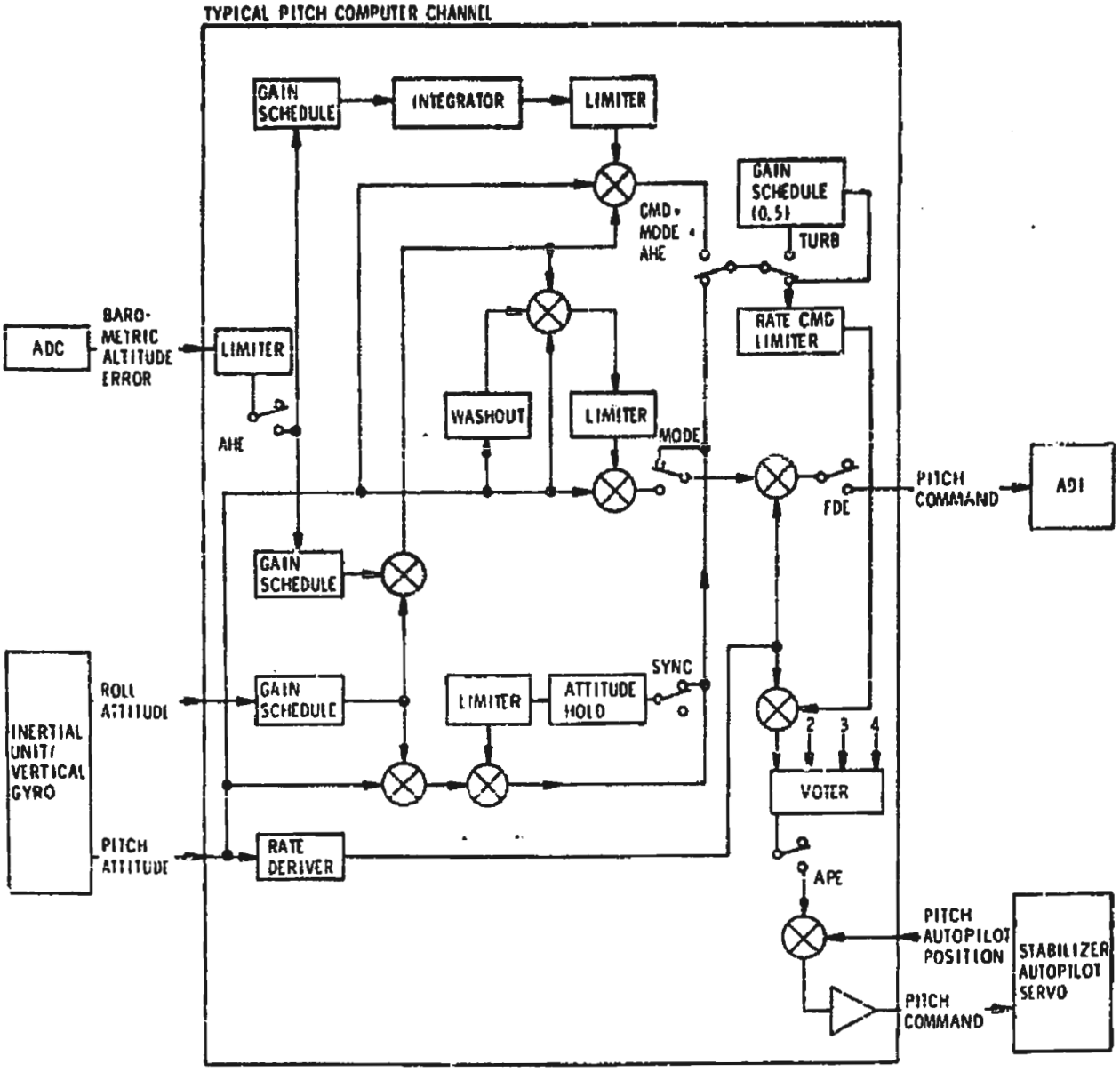
APE • AUTOPILOT ENGAGE
$\overline{CMD}$ • COMMAND NOT
CWS • CONTROL WHEEL STEERING
TURB • TURBULENCE MODE
FDE • FLIGHT DIRECTOR ENGAGE
$\overline{MODE}$ • NO PITCH MODE ENGAGED

M1-0000-22-4108

R Pitch Attitude Hold Mode with Control Wheel Steering
R Figure 4

EFFECTIVITY: ALL

001B



LEGEND:

AHE • ALTITUDE HOLD ENGAGE
APE • AUTOPILOT ENGAGE
FDE • FLIGHT DIRECTOR ENGAGE
• • AND
• • OR

MM-0000-22-4109

R
R

Altitude Hold Mode
Figure 5

EFFECTIVITY: ALL

0018

R engages. The synchronization function of the ADC
R maintains the altitude-sensing function at a signal null, so that aircraft altitude existing at engagement is held.

Any aircraft deviation from the engaged barometric
R altitude results in the ADC generating an error signal. This error signal is processed in the pitch computer to control the aircraft to the referenced altitude. The altitude error is scheduled as a function of true airspeed as gain compensation over the entire speed regime of the aircraft. An altitude integration signal is also developed which is used to compensate for steady-state error signals.

In order to compensate for the loss of altitude in turns, an up-attitude (versine) signal is developed in the pitch computer. This signal is a function of
R aircraft roll from the inertial units/ vertical gyros and TAS.

(3) Control Wheel Steering

Control wheel steering provides a means of maneuvering the aircraft with the autopilot engaged either in the basic (CWS) configuration or in the command (CMD) configuration with no guidance mode selected. Pitch forces in excess of 2 pounds applied to the control wheel are transmitted to the force sensors in the control wheel hub, which generate output steering signals proportional to the applied force. The signals activate triggers in the pitch computers to configure the autopilot to command aircraft maneuvering rate proportional to the wheel force applied. Upon releasing the wheel force, the triggers are deactivated.

Each control wheel contains dual pitch force sensors so that each pitch computer receives a signal from both the Captains and First Officers wheels (Ref. Fig. 6). The sum of the two signals is amplified, fed through a dead zone, and then applied to a trigger. The dead zone prevents small inadvertent forces on the wheel from entering the autopilot channels. During the autopilot CMD configuration, a sustained applied force trips the trigger, which reverts the autopilot to the CWS configuration. The trigger causes the computer to synchronize itself with the attitude of the aircraft. The steering signal is then summed directly with the normal acceleration signal, the resultant of which is the maneuver command rate until the wheel force is released. When the force is released, the trigger is

deactivated which causes the computer to maintain the aircraft at the attitude when the wheel force was released.

If maximum attitude limits are exceeded by control wheel steering, release of the wheel force causes the pitch computers to steer the aircraft back to and maintain the maximum pitch attitude.

(4) Mach Hold

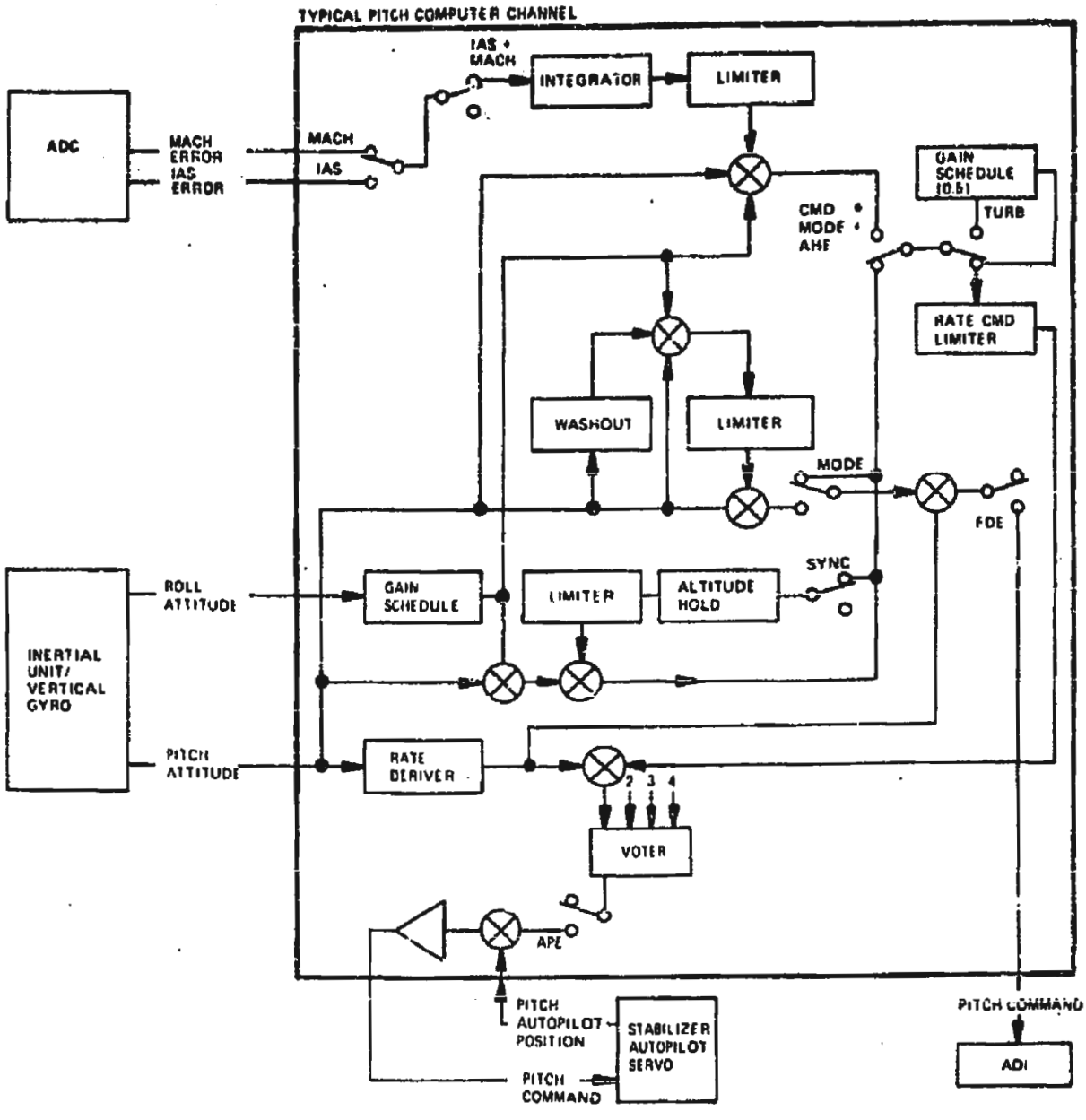
The Mach hold mode (Ref. Fig. 6) may be engaged with either autopilot in CMD and/or at least one FD on. The mode is engaged by depressing the MACH switchlight on the HEADING/PITCH MODE command panel. The MACH mode engages if the Mach data in the CADC is valid, the turbulence (TURB) mode is not engaged, and the approach (APR) or AUTOLAND (A/L) mode is not selected. The mode engagement causes the MACH switchlight to come on, the AFCS MODES indicators to annunciate the MACH mode, and the autothrottle system to disengage.

R When the Mach mode is engaged, a Mach hold engage
R signal is sent to the ADC to clutch in the Mach hold
R synchro. Before engagement, the ADC Mach hold function
R circuit monitors Mach changes so that the Mach number
R existing at the time of mode engagement can be held.
R Any increase or decrease in Mach number causes the ADC to send an error signal to the pitch computer. The pitch computer processes the error signal to provide a command signal which produces a change in the aircraft pitch attitude.

(5) Indicated Airspeed Hold

The IAS (indicated airspeed) hold mode (Ref. Fig. 6) may be engaged with either autopilot in CMD and/or at least one FD on. The IAS hold mode is engaged by depressing the IAS switchlight on the HEADING/PITCH MODE command panel. The IAS mode engages if the CADC computed airspeed is valid, the turbulence (TURB) mode is not engaged, and the approach (APR) or AUTOLAND (A/L) mode is not selected. The IAS hold mode engagement causes the IAS switchlight to come on, the AFCS MODES indicators to annunciate the IAS mode, and the autothrottle system to disengage.

R When engaged, the pitch computer sends an IAS hold
R engage signal to clutch in the IAS hold synchro in the
R ADC. Any deviation from the indicated airspeed at the time of engagement results in the ADC supplying an airspeed error signal to the pitch computer. The



LEGEND

V NAV	- VERTICAL NAVIGATION
AHE	- ALTITUDE HOLD ENGAGE
APE	- AUTOPILOT ENGAGE
FDE	- FLIGHT DIRECTOR ENGAGE
•	- AND
+	- OR

M1-0000-22-4110

R Mach Hold and Indicated Airspeed Hold Modes
R Figure 6

signal is processed in the pitch computer to adjust the aircraft pitch attitude.

(6) Vertical Speed

The VS (vertical speed) hold mode (Ref. Fig. 7) may be engaged with either autopilot in CMD, and/or at least one FD on. The VS hold mode is engaged by depressing the VS switchlight on the HEADING/PITCH MODE command
R panel. The VS mode engages if the ADC true airspeed and barometric altitude data are valid, the turbulence (TURB) mode is not engaged, and the glideslope is not captured. The mode engagement lights the VS switchlight and causes the annunciation of the VS mode on the AFCS MODES indicators.

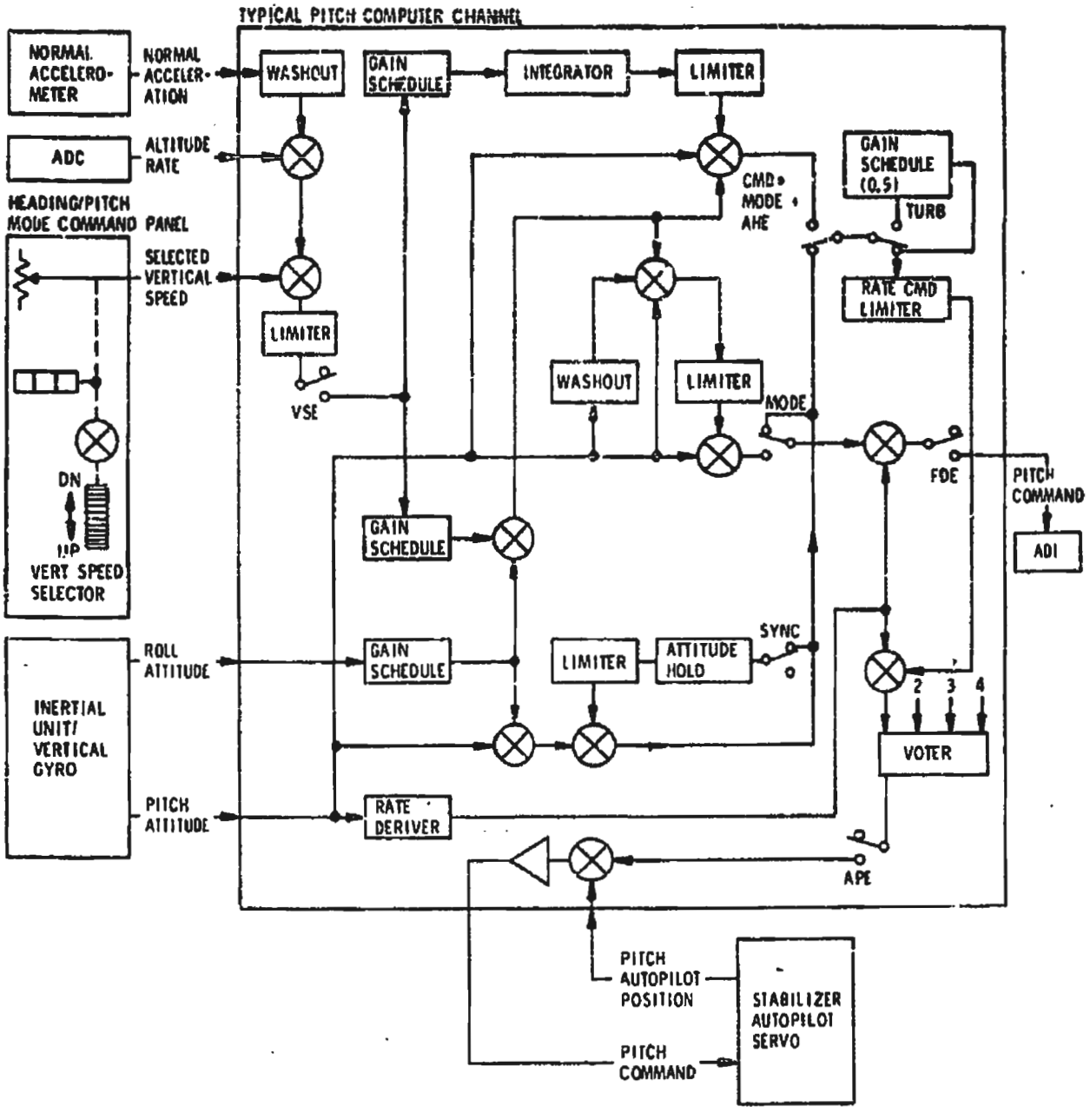
R Before engagement, an altitude rate output from the ADC
R is applied to the VS synchronization network in the pitch computer. The synchronization network drives the VERT SPEED indicator on the HEADING/PITCH MODE command panel to the existing aircraft vertical speed. When the VS mode is engaged, the aircraft maintains the vertical speed existing at the time of engagement. After engagement, the ascent or descent vertical speed rates can be adjusted with the VERT SPEED selector knob. The VS hold mode is disabled automatically when the altitude hold mode is engaged.

(7) Altitude Select

The altitude select mode (Ref. Fig. 8) allows selection of desired flying altitude. A desired altitude is manually selected and the pitch channel is armed for altitude capture using the ALT SELECT panel. After selecting the desired altitude on the panel ALTITUDE SELECT counter, the ARM switchlight is depressed to arm the pitch computer for altitude capture computation. The altitude select ARM mode engages if the turbulence (TURB) mode and the approach (APR) or AUTOLAND (A/L) mode are not engaged. The mode engagement lights the ARM switchlight and causes the AFCS MODES indicators to annunciate the ALT ARM mode.

The altitude select ARM mode can be engaged while the pitch channel is operating in the vertical speed (VS) hold, the indicated airspeed (IAS) hold, the MACH hold, or the pitch attitude hold precapture mode. The VS, IAS, or MACH mode is annunciated in addition to the ALT ARM mode on the AFCS MODES indicators.

The altitude capture command is computed by the pitch computer as a function of the altitude error derived



LEGEND:

AHE • ALTITUDE HOLD ENGAGE
APE • AUTOPILOT ENGAGE
FDE • FLIGHT DIRECTOR ENGAGE
VSE • VERTICAL SPEED ENGAGE
• AND
• OR

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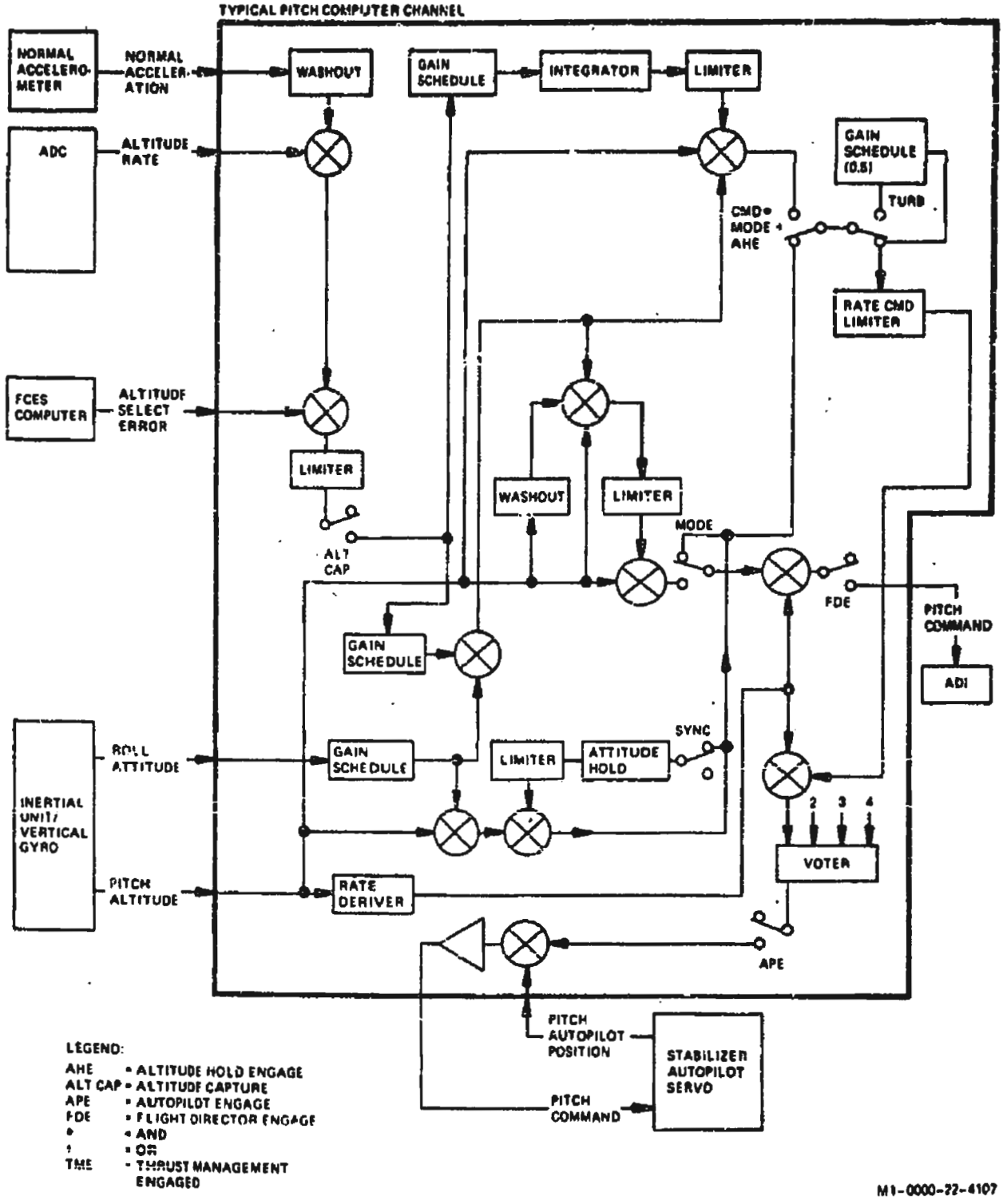
R
R

Vertical Speed Hold Mode
Figure 7

EFFECTIVITY: ALL

001B



R
R

Altitude Select Mode
Figure 8

EFFECTIVITY: ALL

001B

from the selected altitude and the actual barometric altitude. The differential resolvers in the ALT SELECT panel compare the selected altitude with the barometric altitude synchro signals from the barometric altitude indicators (Ref. 34-14-00). The resultant signals are the altitude select error signals applied to the FCES computer altitude channels. Each channel processes the error signal for the altitude alert function (Ref. 22-17-00) and the output to the pitch computers. The altitude capture command is computed by the pitch computer as a function of the altitude error derived from the selected altitude and the actual barometric altimeter.

The altitude select error signal from one altitude channel is selected before leaving the FCES computer to be applied to both pitch computers. The selection is controlled by the NORM/STBY switch on the ALT SELECT panel. When the switch is placed in the NORM position, both pitch computers receive altitude select error signals from FCES computer channel No. 1 (normal). When the switch is placed in the STBY position, the pitch computers are connected to FCES computer channel No. 2 (standby).

When the ARM mode is engaged, the pilot must point the aircraft to the selected altitude either manually or through a precapture mode (IAS, MACH, VS or ATT HOLD). The pitch computers use the altitude select error signal and altitude rate to acquire altitude capture. Upon capture, the pitch computers disengage the altitude arm mode and automatically engage the altitude hold mode. Altitude hold is maintained as described in Paragraph 2C(2). On the ALT SELECT panel, the ARM switchlight goes off. On the HEADING/PITCH MODE command panel, the precapture guidance mode switchlight IAS, MACH, or VS) goes off, and the ALT switchlight comes on. On the AFCS MODES indicators, the ALT ARM and VS, IAS, or MACH annunciations disappear, and the ALT annunciator appears.

3. Altitude Select Panel

A. Description and Operation

The altitude select (ALT SELECT) panel is used to preselect a desired flight altitude to be captured by the auto flight system. The panel contains an altitude select knob with corresponding digital counter, a channel select switch, an ARM switchlight, and a ground check TEST pushbutton switch.

The simplified schematic (Ref. Fig. 9) shows the functions of the controls.

The altitude select knob is used to select the desired altitude. The control knob is rotated until the desired altitude is read out on the ALTITUDE SELECT counter. Selection is possible for all altitudes from 0 to 59,900 feet with a resolution of 10 feet. The ALTITUDE SELECT counter consists of three rotating wheels. The first and second digits are on two individual rotating parts which are shifted by a Geneva mechanism to reflect each 10,000-foot and each 1,000-foot change selected. The third rotating part of the counter contains the last three digits of altitude in 100-foot divisions and the vernier scale with each division representing 20 feet of altitude.

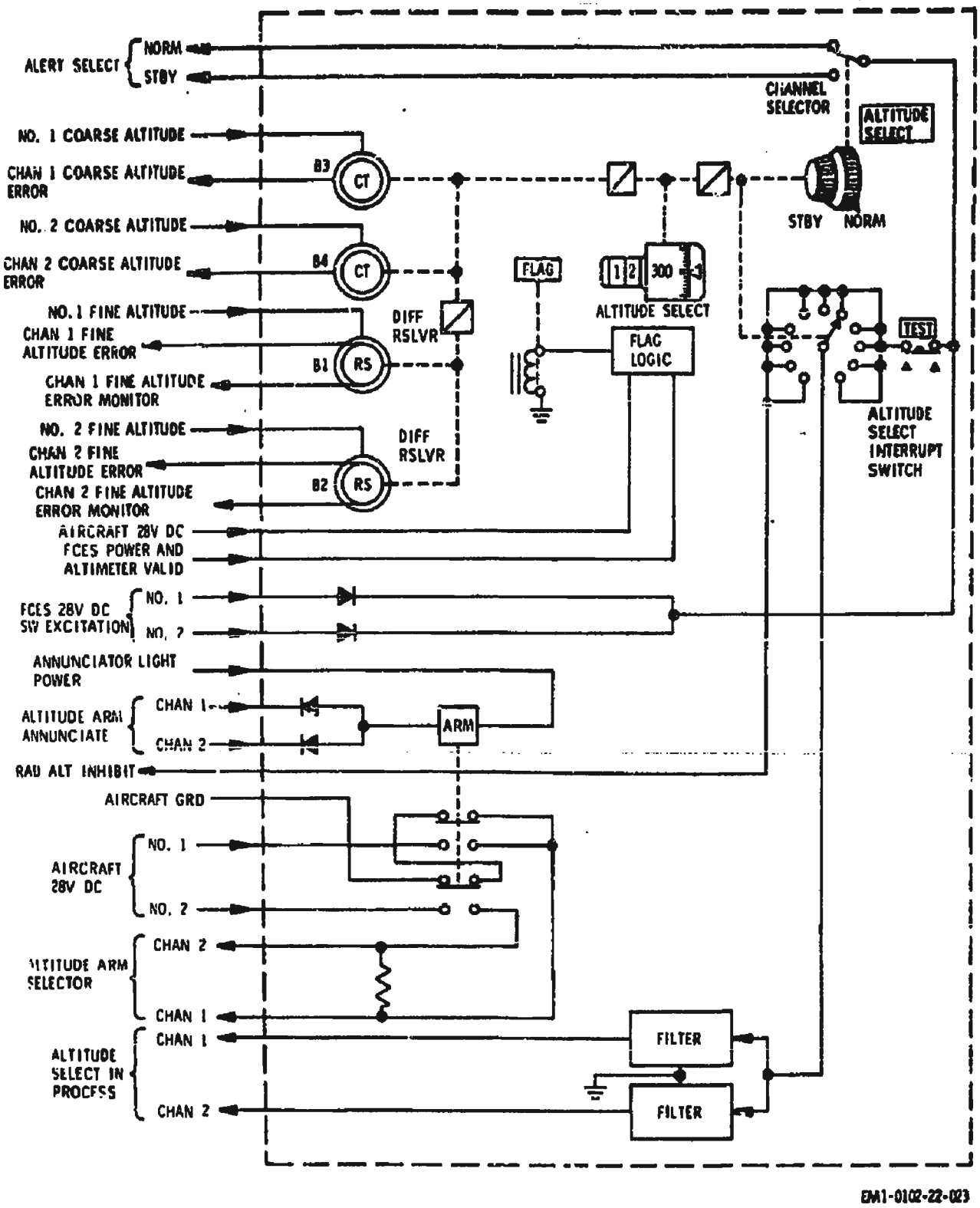
The altitude ARM switchlight is used to arm the altitude select circuits in the pitch computers. After selection of the desired altitude, the switchlight is momentarily depressed to establish logic in the pitch computers to enable automatic capture of the selected altitude. When the armed status is established, the switchlight comes on. When the selected altitude has been reached, and the computers have shifted to altitude capture, the ARM switchlight goes out.

The channel select switch is a two-position switch that is concentric with the altitude select knob. The switch permits selection of either channel 1 (NORM) or channel 2 (STBY) of the altitude select and altitude alert functions. The TEST pushbutton switch is used by ground maintenance personnel to check the altitude alert channels.

The ALT SELECT panel is used to determine the altitude select error as a function of barometric altitude. If the barometric altitude sensor provides an invalid input, a red flag appears in the ALTITUDE SELECT counter window. The flag also appears when a controlling power is lost in the associated altitude select/alert circuitry. Four differential resolvers are mechanically connected to the altitude select knob. Two resolvers are used for each channel of the altitude functions, one receiving a fine barometric altitude and the second receiving a coarse barometric altitude signal from the associated barometric altimeter. The resolvers compare these inputs with the selected altitude. The resultant altitude error signals are transmitted to the associated altitude select/alert channel.

4. Pitch Computer

A. Description



EM1-0102-22-023

Altitude Select Panel Simplified Schematic Diagram
Figure 9

The pitch computer is housed in a 3/4 ATR case. The front panel contains fault isolation monitor annunciator, and a carrying handle. Mounting hooks are provided to secure the case to a rack. Two dual electrical connectors are provided on the rear of the case for system interface.

There are two identical pitch computers either of which can provide pitch axis control. The computers are located in the forward electronics service center. Each computer incorporates analog, logic, and monitoring circuits required for autopilot and flight director pitch axis control. Each computer contains a single computation channel for the cruise, approach, takeoff, and go-around modes of operation, and dual computation channels for the AUTOLAND mode.

5. Normal Accelerometer Unit

A. Description and Operation

The normal accelerometer unit consists of a housing mounted on a cast mount. The housing contains three identical and independent vertically mounted accelerometers. Three electrical receptacles are provided on the mount, one for each accelerometer.

The accelerometers are excited by +12V dc and -12V dc. The three accelerometers individually sense aircraft vertical accelerations and produce proportional voltages which are applied to the dual system. The unit is oriented to produce a positive voltage for an upward vertical acceleration.

The normal accelerometers provide the pitch computers with signals during control wheel steering operation, and during the approach, AUTOLAND, vertical speed, and altitude select modes of operation. Signal trace wires from pitch computers through accelerometers insure that the units are connected.

6. Stabilizer Autopilot Control Servo

A. Description

The stabilizer autopilot control servo consists of two separate manifold assemblies which are interconnected and integrated into a single unit. The servo is located in the lower section of the afterbody, between the left and right stabilizer servos (Ref. Fig. 10). The output arm of the autopilot servo is externally coupled to both stabilizer servo linkage system through dual linkages (Ref. 27-41-00).

Each of the two identical channels of the autopilot servo receives independent electrical position commands from the associated autopilot system. The output motion of the autopilot servo is coupled to a linkage system that interconnects the Captains and First Officers stabilizer servo input linkage. Thus, position commands from the autopilot servo displace the dual spool control valves in both stabilizer servos which results in stabilizer movement. The autopilot servo sub-assemblies and components are described below and schematically shown in Figure 11.

(1) Solenoid Shutoff Valves

Three electrically controlled hydraulic solenoid shutoff valves are mounted on autopilot servo manifold A, and three on manifold B. They are the pressurization, the engage, and the force level override solenoid valves which provide the means for selectively energizing sections of the autopilot control mechanism with hydraulic pressure. The pressurization solenoid valve controls the hydraulic pressurization of associated autopilot servo actuator. The engage solenoid valve when energized engages the mod piston. The force level override solenoid valve, energized during autopilot AUTOLAND mode, causes the regulated hydraulic pressure to be doubled for an increased override force requirement.

Each solenoid shutoff valve is a plate mounted, electrically controlled, two-position, three-way hydraulic valve (Ref. Fig. 12) which contains a pressure supply port, a cylinder port, and a system return port. Each valve functions to open the cylinder port to either pressure or to return. Each valve is mounted to autopilot servo with four screws, and is sealed by a gasket plate face seal. The valve consists of a double coil assembly, filter, sleeve assembly, and a ball check valve assembly. The filter, installed in the pressure supply manifold of the valve, insures the supply of contaminant free oil.

With the solenoid deenergized, a spring loaded plunger holds the ball on the pressure inlet seat, against system pressure. This opens the cylinder port to system return so that no hydraulic pressure can build up in the shutoff valve cylinder port.

When the solenoid is energized by 28V dc, the double coil magnetic force on the plunger core and the systm pressure on the ball overcome the plunger spring force to raise the plunger. System pressure then holds the ball against the return seat and opens the pressure

port to the shutoff valve cylinder port. Loss of solenoid electrical power will allow the spring loaded plunger to force the ball on the pressure inlet seat, thus shutting off hydraulic flow to the shutoff valve cylinder port.

(2) Electro-hydraulic Servo Valve

The electro-hydraulic servo valve (Ref. Fig. 13) is mounted on each autopilot servo manifold. The servo valve receives electrical command signals from the asscciated pitch channel of the autopilot system and converts it into a proportional hydraulic pressure. The hydraulic pressure is ported to the associated modulating piston.

The electro-hydraulic servo valve is a four-way proportional valve that controls the flow of hydraulic fluid to and from the stabilizer autopilot servo. The hydraulic flow developed by the valve is proportional in magnitude and direction to the differential current applied to the valve torque motor.

The servo valve is essentially a signal converter and a two-stage hydraulic amplifier. The valve receives small electrical signals and converts them to large hydraulic output signals which are used to drive the autopilot servo. The valve consists of a torque motor, a jet-pipe first stage nozzle with mechanical feedback, and a second stage four-way spool valve coupled to the first stage nozzle through the feedback spring (Ref. Fig. 13). A 200 micron filter, installed in the valve pressure manifold, insures contaminant free fluid supply to the valve. The servo valve is attached to the autopilot servo assembly by four screws, and is hydraulically sealed by a plate type gasket face seal. Two of these valves are installed on the autopilot servo, one for each channel.

The torque motor is an electromagnetic device which consists of two pole shoes, two coils connected to the pitch autopilot computer, and an armature which is coupled to the first stage nozzle. The nozzle is held in the neutral (hydraulic null) position by a spring.

(3) Modulating Piston

The modulating (mod) piston is installed in each autopilot servo manifold. The mod piston drives the output shaft rotor assembly in response to the hydraulic pressure from the associated electro-hydraulic servo valve. The outputs of the two

mod pistons are mechanically summed within the output shaft rotor assembly.

(4) Mod Piston Coupler

The mod piston couplers provide attach points to the linkage elements connecting the mod pistons to the output arm. The couplers produce the necessary mechanical motion to position the output arm in response to the output flow and pressure from the electro-hydraulic servo valve.

(5) Output Shaft Rotor Assembly

The output shaft rotor assembly translates the movement of the mod piston into a movement of the output arm. The rotor assembly contains two levers (short throw and long throw) connected to a shaft contained within a housing. The engage and force limiter assembly locks the levers against the housing assemblies for coupling. The long and short levers provide different override force levels in the pitch up or pitch down configuration.

(6) Engage and Override Force Limiter

The engage and override force limiter consists of piston mechanisms that load against the output shaft rotor assembly to provide a structural reference for the output linkage system and a means to limit the autopilot servo force authority. The piston consists of three separate piston elements in a common cylinder. The middle element is an idler-pressure separator piston and the two end elements are the primary and secondary channel loading pistons. The idler-pressure separator piston has four pressure faces. Porting to the idler piston is fixed so that the two return pressures separate the two supply pressures and the return pressures are separated by one of the piston lands. Movement of the three pistons in engaging the linkage system depends on which of the autopilot servo channels is activated.

(7) Pressure Control Valve

The pressure control valve is a spring-loaded valve incorporated in both hydraulic loops of the autopilot servo. The valves function to maintain the close tolerance hydraulic pressures required to establish force authority valves at low (cruise) and high (takeoff or land) levels. The pressure levels are changed by the high level override solenoid valve.

(8) Relief Valve

Each pressure control valve circuit contains a relief valve which acts as a backup when the pressure control valve fails. The relief valve limits the pressure to a value approximately ten percent above the regulated pressure. This relief valve function prevents excessive increase in autopilot authority and override force upon a pressure control valve failure.

(9) Pressure Switch

Two hydraulically actuated electrical switches are installed in each autopilot servo channel to monitor fluid pressure and to indicate the mode of operation. One of the switches in each channel is the engage and override warning monitor pressure switch which is pressurized and activated when the engage and override force limiter is fully engaged. The second switch in each channel is the high level override pressure switch which is pressurized and activated when the autopilot servo is in high level override force mode of operation. The switches receive the 28V dc signals from the autopilot system and the activated switches return the monitor signals to the system.

(10) Autopilot Position Transducer

The two autopilot position tranducers, one in each channel of the autopilot servo, are the dualized linear variable differential transformers (LVDT) compatible with dualized autopilot system channels. The autopilot position transducer is connected between the trim input arm and mod piston output, and senses the position difference between them. An equivalent electrical signal is fed back to the associated autopilot channel to close the servo control loop. This results in an electro-hydraulic servo valve null and mod piston operation relative to a stabilizer trim position. The transducers receive the 26V ac excitation voltage from the associated autopilot system pitch computer.

(11) Autotrim Transducer

Two autotrim transducers (two dual LVDT) are installed in the autopilot servo to sense the relative position of the output and trim input arms. An electrical signal equivalent to the position difference sensed is transmitted to the associated channels of the flight control electronics system (Ref. 22-17-00). The system processes the signal for use in the automatic trim and direct lift control functions. The transducers receive

the 26V ac excitation voltage from the system trim augmentation computer.

(12) Check Valve

Four identical cartridge-type check valves are installed in each autopilot servo manifold. One of the check valves functions to maintain case pressure equal to or lower than return pressure. The second check valve dumps regulated pressure to the case when the engage solenoid valve is deenergized. The remaining two check valves function as bypass valves for the mod piston when the pressurization solenoid valve is deenergized.

(13) Case Relief Valve

A case relief valve is installed in each autopilot servo manifold. The valve serves to protect the structural integrity of the manifold when the system fails. When actuated, the valve vents hydraulic fluid into the atmosphere.

(14) Thermal Bleed Orifice

The thermal bleed orifice in each autopilot servo channel permits hydraulic fluid flow through the servo channel while the servo channel is deenergized. The fluid flow prevents the hydraulic fluid within the servo from cooling excessively.

(15) Filter Element

A recleanable-type metal filter element is installed in each autopilot servo manifold. The filter protects the autopilot servo components from fluid contaminants.

B. Operation

The two autopilot servo channels are activated independently by the engagement of the respective autopilots (A and B) through the autopilot engage switches on the APFDS ENGAGE panel. Only one autopilot, consequently the associated autopilot servo channel, can be engaged during cruise. If both autopilots are engaged during AUTOLAND only, then both autopilot servo channels will be active.

When an autopilot is engaged by setting the autopilot engage switch in the CWS or CMD position, the 28V dc signal is applied to the solenoid valves and the pressure switches of the associated autopilot servo channel (Ref. Fig. 11). The prescurization solenoid valve energizes first and ports the

supply hydraulic pressure to the engage solenoid valve and the electro-hydraulic servo valve. The servo valve provides a command to synchronize the mod piston and associated linkage system with the control column position to minimize engage transients when the autopilot servo engages.

After a short time delay, the engage solenoid valve is energized. The solenoid valve ports the supply hydraulic pressure to the pressure control valve where the pressure is regulated. The regulated pressure is applied to the engage piston in the mod piston couplers and the coupler preload piston, moving both pistons into the engage position. When the mod piston coupler engage piston is properly positioned, internal orifices direct a portion of the regulated pressure to the engage and override force limiter. The force limiter pistons move into the extended position and lock the internal levers of the output shaft rotor assembly to the rotor assembly housing. This action couples the assembly housing to the output shaft assembly, causing shaft movement. Movement of the three pistons in the engage and override force limiter depends on which autopilot servo channel is activated. Activating only the primary channel drives all three pistons towards the rotor to engage the linkage system. Activating only the secondary channel drives the secondary piston toward the rotor to engage the linkage system and moves the idler and primary pistons in the opposite direction out of the way. During dual channel high force level operation discussed below, the primary force output is greater than the secondary force output so that all three pistons are stacked against the rotor.

With the engage and override force limiter engaged by the activation of either autopilot servo channel, the autopilot servo is now operative in the low level override force mode. Upon engagement of the engage and override force limiter, hydraulic pressure is directed to the engage and override warning monitor pressure switch which signals the associated autopilot system.

Pitch command signals from the autopilot are applied to the electro-hydraulic servo valve which converts them to the proportional hydraulic flow and control pressure. The control pressure from the servo valve moves the mod piston. Movement of the mod piston is translated into a movement of the output arm by the output shaft rotor assembly. If both mod pistons are operating, their outputs are mechanically summed within the output shaft rotor assembly.

As the mod piston moves in response to incoming command signals, balancing signals are generated by the autopilot position transducer. The autopilot position transducer senses the position difference between trim input arm and

mod piston output. The equivalent electrical signal is fed back to the autopilot to assist in nulling the electro-hydraulic servo valve when the commanded position has been attained.

The autopilot servo output arm is connected to the left and right stabilizer servo dual control linkage. Consequently, the autopilot servo output positions the dual spool control valve of both stabilizer servos which results in stabilizer movement.

When the autopilot is engaged in the AUTOLAND track mode, the autopilot servo assumes the high level override force mode of operation. Upon AUTOLAND track engagement, the autopilot sends a command signal to energize the force level override solenoid valve. The energized solenoid valve ports the supply hydraulic pressure to the pressure control valve, causing the control valve to approximately double the regulated pressure. The increased regulated pressure is now applied to the engage and override force limiter, to approximately double the override force required. During dual channel high level force operation, primary and secondary pistons within the engage and override force limiter provide for two high override force levels. The secondary force level is established lower than the primary force level to ensure that the primary piston remains in the engaged position regardless of extremes of the regulated pressure in both channels.

The autotrim transducers sense the position difference between the output arm and trim input arm. Electrical outputs are fed to the pitch trim system (Ref. 22-18-00) as the stabilizer-out-of-trim signals. The system trim augmentation computer processes the signals for use in automatic trim computations and also feeds the processed signals to the system FCES computer for use in direct lift control computations.

C. EHV Operation

Hydraulic system pressure is supplied to the servo valve where the oil is filtered and ported to both pressure ports of the second stage spool valve and to the first stage nozzle. With a balanced electrical signal applied to the two coils of the torque motor, the nozzle is held in the neutral position. In this condition, the nozzle oil-jet impinges equally on both second stage spool receiver jets thus producing equal hydraulic pressures across the second stage spool, which maintain the second stage spool in the null position.

An autopilot electrical input command signal produces an unbalanced magnetic force in the torque motor and causes the armature and nozzle to rotate slightly. In this condition, the nozzle oil-jet impinges unequally on the second stage spool receiver jets and produces a differential pressure across the second stage spool which displaces the spool. Displacement of the second stage spool controls hydraulic flow and pressure to the autopilot servo actuator. The actuator is coupled to a position transducer (LVDT) which senses actuator displacement and provides the feedback signal to the pitch autopilot computer, which completes the servo position loop.

Displacement of the second stage spool also applies a mechanical force through the feedback spring which tends to return the nozzle towards the null position. The internal mechanical feedback mechanism stabilizes servo valve operation and provides for more accurate servo valve positioning.

7. AFCS/MLG Accessory Unit

A. Description

The AFCS/MLG accessory unit is located in the forward electronic service center, center rack (Ref. Fig. 1). The unit provides the roll computers signals that indicate whether the aircraft is airborne or on the ground. Removal of the unit during ground testing simulates aircraft airborne. For a detailed description of the unit, see 22-10-00.

8. AFCS MODES Annunciator

A. Description

There are two AFCS MODES annunciators, one located on the Captains instrument panel and the other on the First Officers instrument panel (Ref. Fig. 1). The AFCS MODES annunciator provides a visual display of the APFDS operating modes when they are engaged. For a detailed description of the annunciator, see 22-10-00.

9. AFCS WARNING Indicator

A. Description

There are two AFCS WARNING indicators, one located on the Captains instrument panel and the other on the First

Officers instrument panel (Ref. Fig. 1). The AFCS WARNING indicators provide visual displays when failures are detected in AFCS operation that require immediate pilot action. For a detailed description of the indicator, see 22-10-00.

10. APFDS ENGAGE Panel

A. Description

The APFDS ENGAGE panel is located in the center on the glareshield panel (Ref. Fig. 1). The panel provides control to engage autopilots A and B, flight directors A and B, and turbulence mode. For a detailed description of the panel, see 22-10-00.

11. HEADING/PITCH MODE Panel

A. Description

The HEADING/PITCH MODE panel is located on the left side of the glareshield panel (Ref. Fig. 1). The panel provides selection of APFDS lateral and vertical modes of operation. For a detailed description of the panel, see 22-10-00.

12. NAV MODE Panel

A. Description

The NAV MODE panel is located on the right side of the glareshield panel (Ref. Fig. 1). The NAV MODE panel provides selection of APFDS navigation modes of operation, and selection of APFDS course data inputs. For a detailed description of the panel, see 22-10-00.

13. System Interface

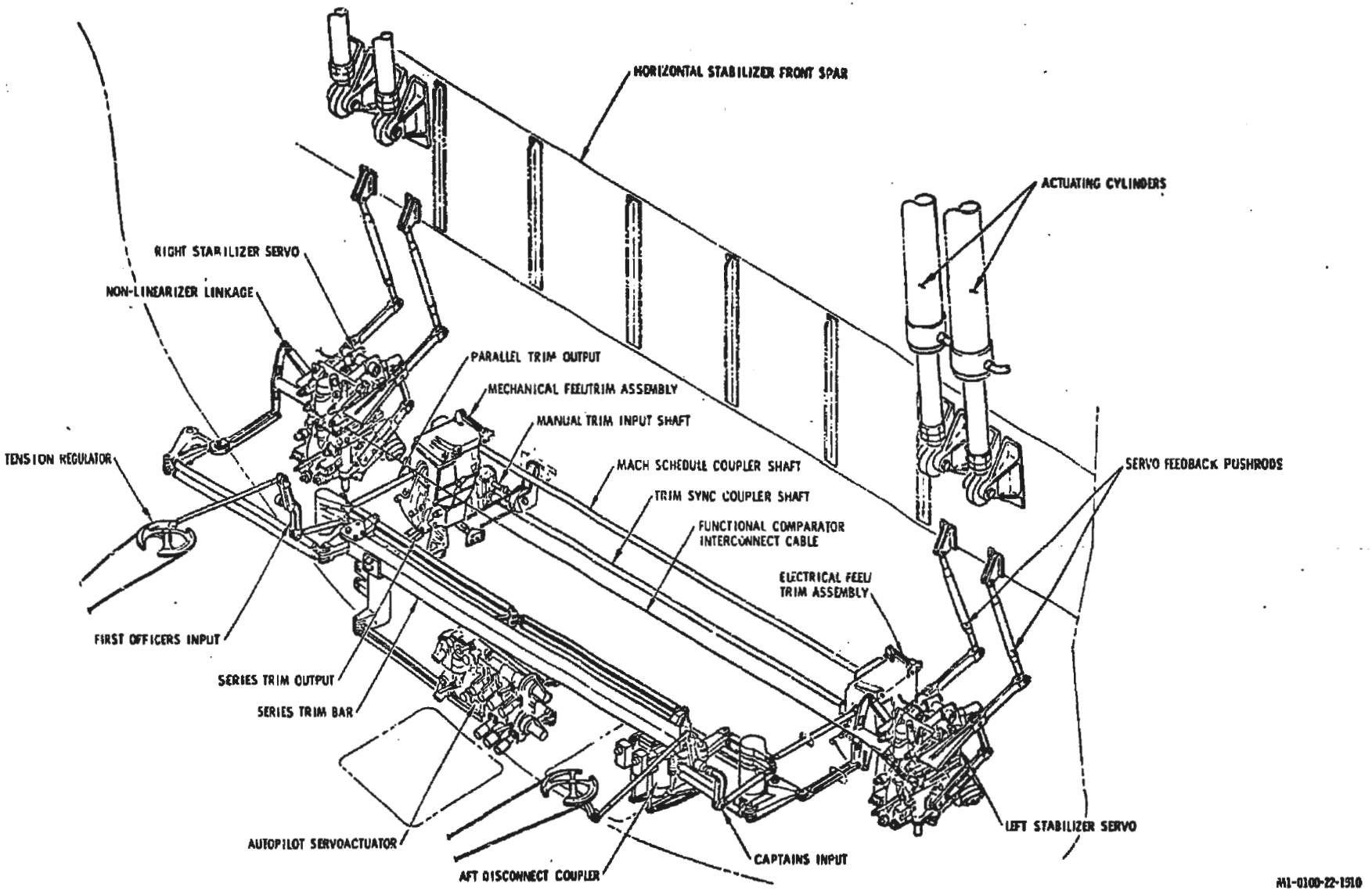
A. The APFD pitch system interfaces with the following equipment:

27-11-00 Autopilot Disconnect Switch (Part of Control Wheel)

27-11-00 Takeoff/Go-Around Switch (Part of Control Wheel)

22-17-00 FCES Computer

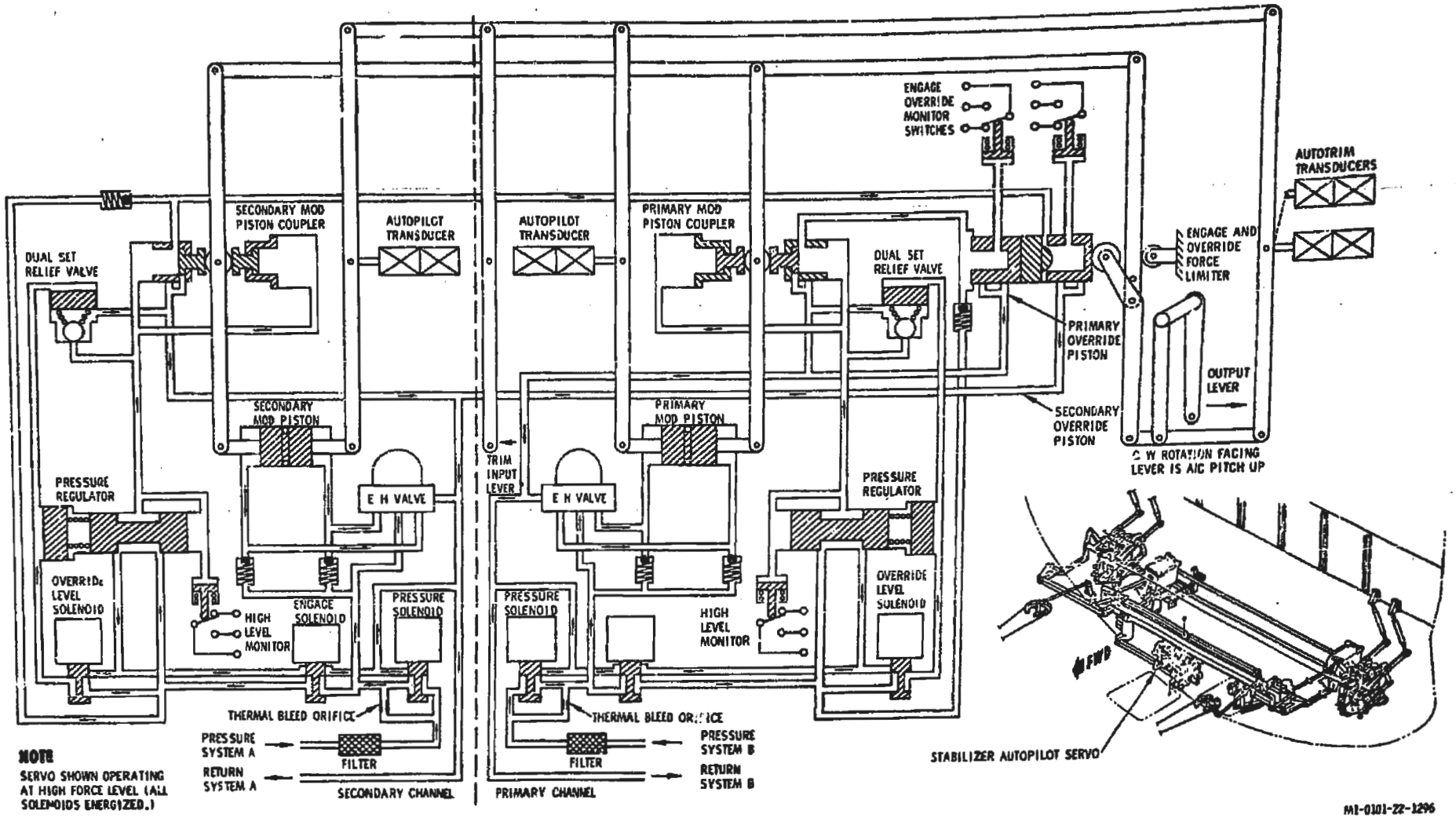
34-32-00 Radio Altimeter



R R Stabilizer Autopilot Control Servo Location
Figure 10

EFFECTIVITY: ALL

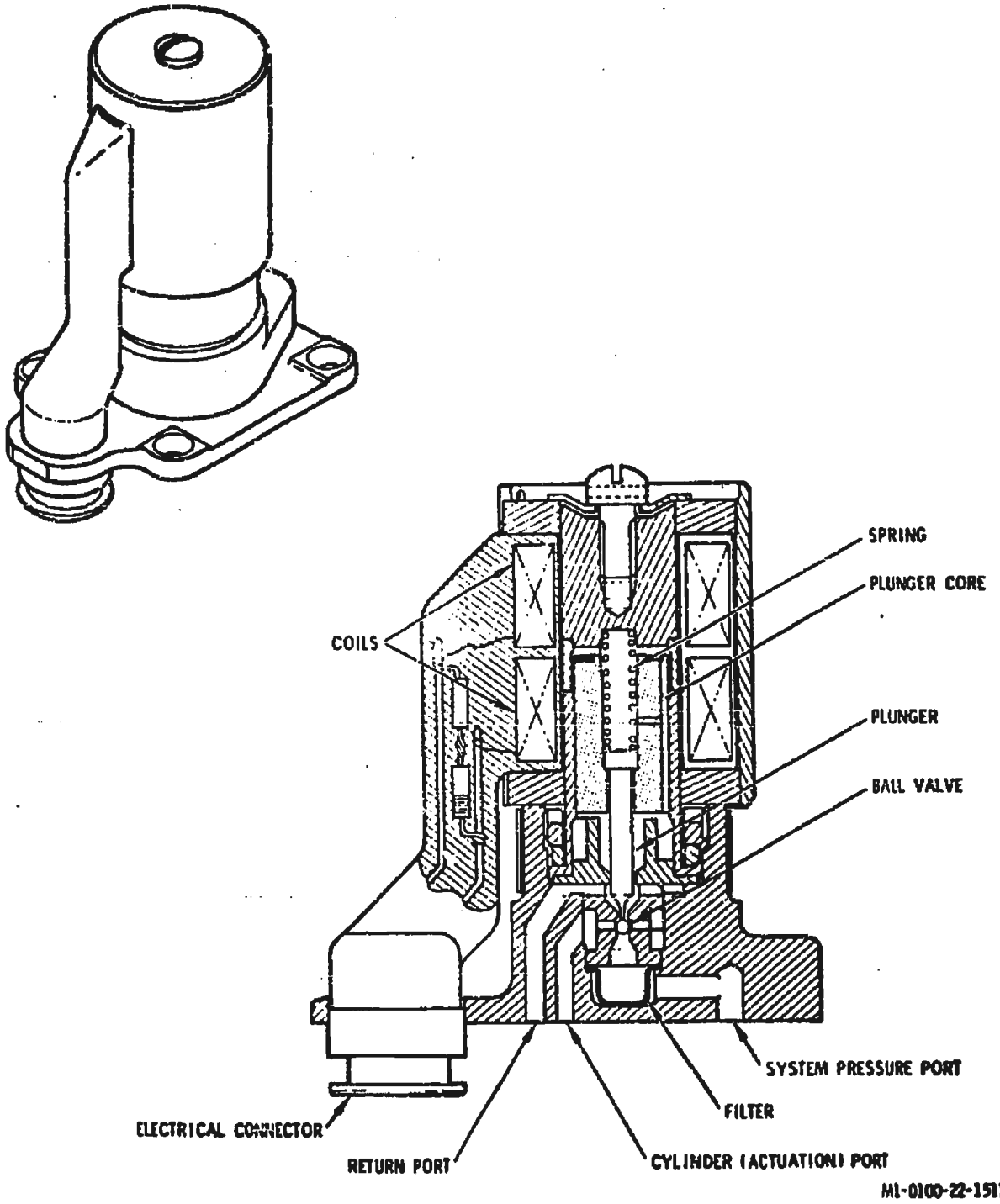
0016



R R Stabilizer Autopilot Control Servo Schematic
Figure 11

EFFECTIVITY: ALL

0018



R
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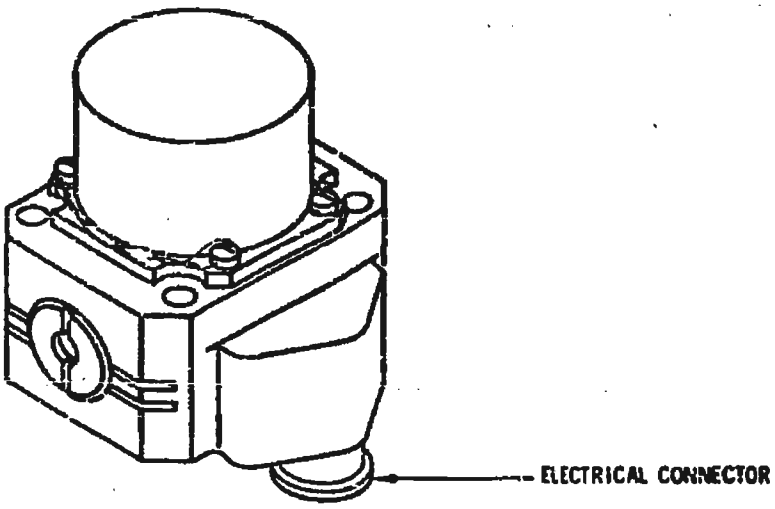
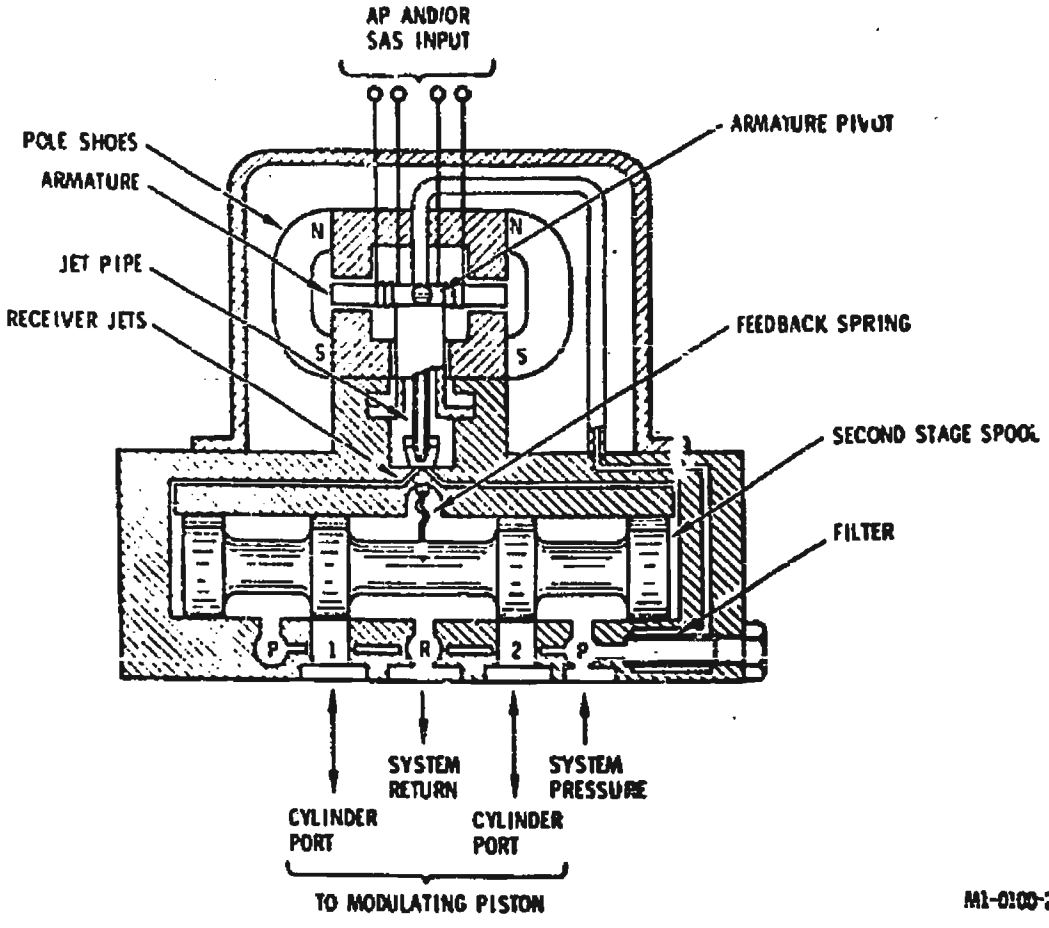
Solenoid Shutoff Valve
Figure 12

EFFECTIVITY: ALL

0018





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R
R

Electro-Hydraulic Servo Valve (EHV)
Figure 13

EFFECTIVITY: ALL

0018

34-33-00 ILS

27-11-00 Pitch CWS Force Transducer (Part of Control Wheel)

34-14-00 Air Data Computer

34-14-00 Barometric Altimeter

34-21-00 Vertical Gyros

27-51-00 Flap Power Drive Unit Switch Box

22-31-00 Speed Control Computer

34-21-00 Attitude Director Indicator

Inertial Nav System

R AUTOPILOT - FLIGHT DIRECTOR PITCH SYSTEM - FAULT ISOLATION

R 1. Fault Isolation Identification

R Autopilot-flight director pitch fault isolation is broken down
R into operational problems encountered during normal flight
R operation and ground testing. Table 101 lists faults and the
R procedures required for fault isolation of the autopilot-flight
R director system.

R Since no fault isolation system can cover every potential
R failure, schematics are provided. The schematics provide the
R necessary information to trace signal flow from source to
R termination.

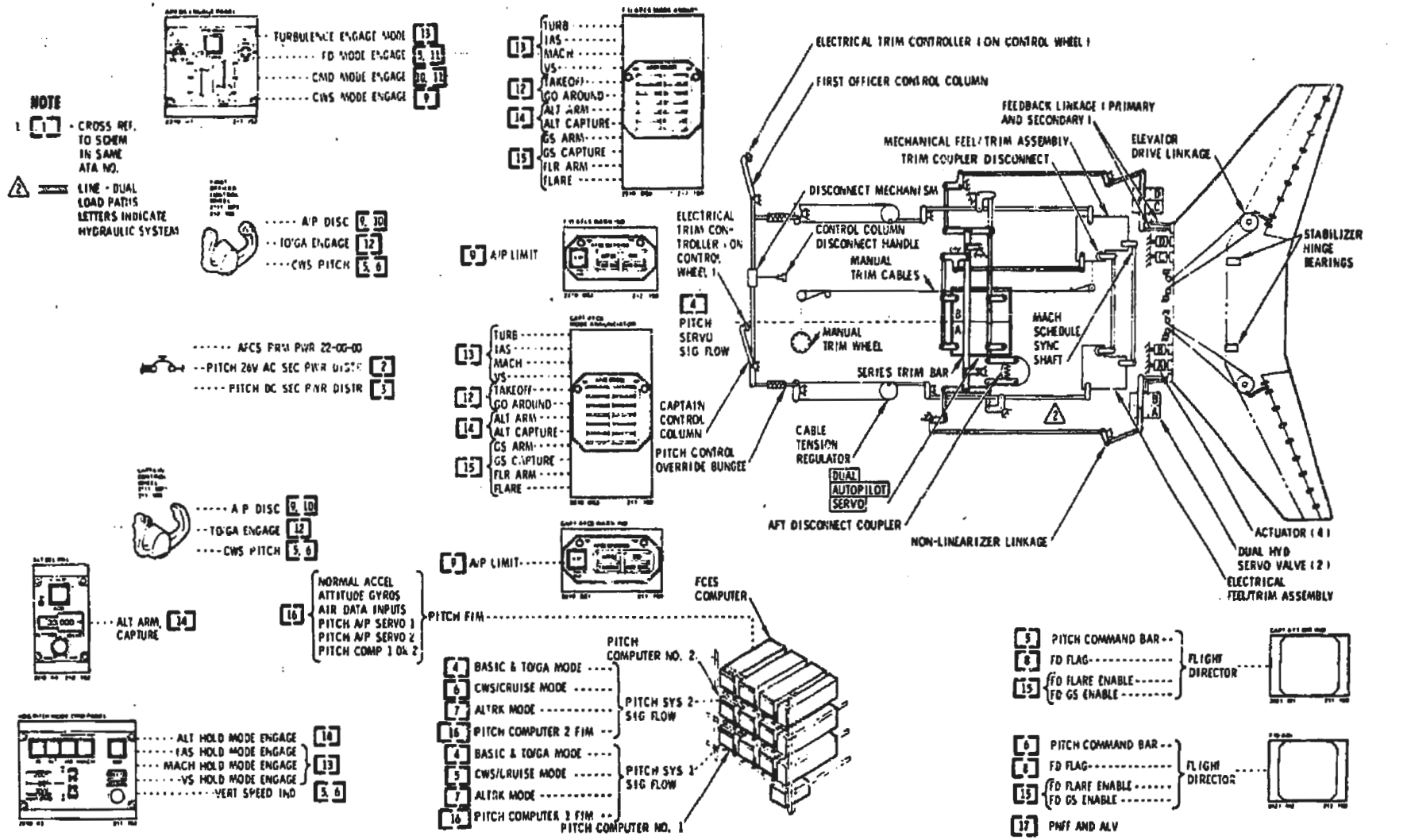
R For troubleshooting aircraft wiring, use tables on schematics
R for listing of applicable diagram in wiring diagram manual.
R Table 102 lists all autopilot-flight director pitch system fault
R isolation diagrams and schematics.

R Autopilot Flt Dir Pitch System Fault Isolation
R Table 101

FAULT SYMPTOM	FAULT ISOLATION	PAGE
FLIGHT DIRECTOR INOPERATIVE	22-10-31	101
FLIGHT DIRECTOR OPERATES INTERMITTENTLY	22-10-31	101
FLIGHT DIRECTOR WILL NOT ACCEPT SELECTED MODE:		
IAS MODE	22-11-37	101
MACH MODE	22-11-39	101
ALT HOLD MODE	22-11-33	101
VS MODE	22-11-31	101
ALT SELECT MODE	22-11-35	101
APR MODE	22-12-21	101
A/L MODE	22-14-33	101
TAKEOFF MODE	22-12-29	101
FLIGHT DIRECTOR FAILS AFTER CAPTURE OF GLIDE SLOPE	22-12-21	101
AUTOPILOT WILL NOT CAPTURE ALTITUDE HOLD	22-11-35	101
AUTOPILOT TRIPS PITCH TRIM FAIL	22-18-00	101
AUTOPILOT WILL NOT ENGAGE IN CWS OR CMD	22-10-33	101
AUTOPILOT WILL NOT ENGAGE IN TURBULENCE MODE	22-11-43	101
NO DUAL MESSAGE	22-14-31	101
DUAL A/L NOT AVAIL LIGHT	22-14-33	101

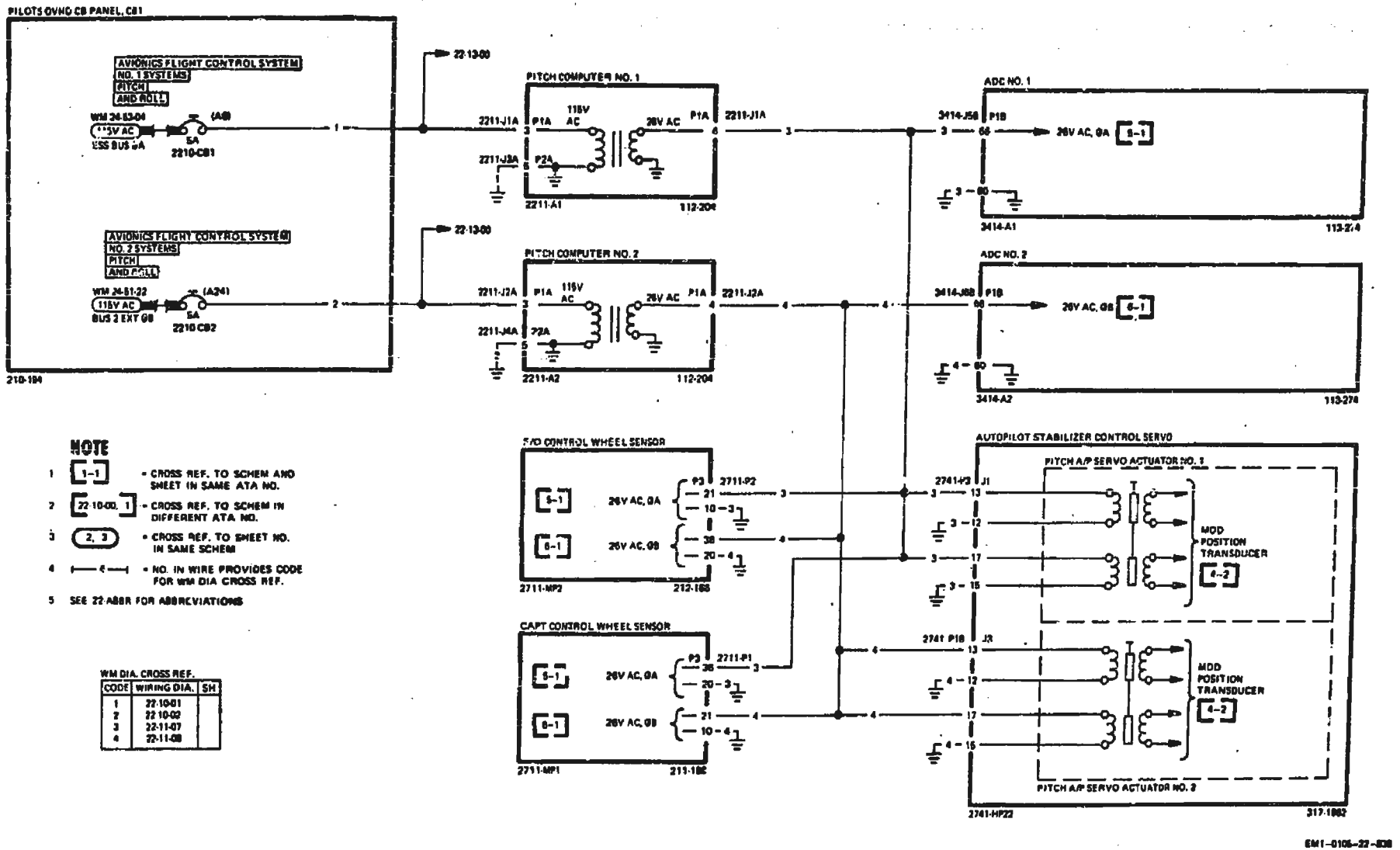
Autopilot-Flt Dir Pitch Sys Fault Isolation Diagram
Table 102

SCHEM NO.	TITLE
1	Pitch System Schematic Locator
2	Pitch 26V AC Secondary Power Distribution Schematic
3	Pitch DC Secondary Power Distribution Schematic
4	Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode Signal Flow Schematic
5	Pitch System No. 1 CWS/CRUISE Mode Signal Flow and FD Switching Schematic
6	Pitch System No. 2 CWS/CRUISE Mode Signal Flow Schematic
7	Pitch Systems No. 1 and No. 2 ALTRK Mode Signal Flow Schematic
8	FD Mode Engage Logic and FD Switching Schematic
9	CWS Mode Engage Logic Schematic
10	CMD Mode Engage Logic Schematic
11	Pitch Command Valid Logic Schematic
12	Takeoff/Go-Around Modes Engage Logic Schematic
13	Turbulence, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic
14	Altitude Arm, Capture, and Hold Mode Engage Logic Schematic
15	Glideslope Capture, Track, Approach Land, and Flare Engage Logic Schematic
16	Pitch FIM Schematic
17	Pitch Computer No First Fail and Pitch A/L Available Schematic



R R Pitch System Schematic Locator
SCHEM 1

EFFECTIVITY: ALL



NOTE

1. [5-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA. CROSS REF.

CODE	WIRING DIA.	SH
1	22-10-01	
2	22-10-02	
3	22-11-07	
4	22-11-08	

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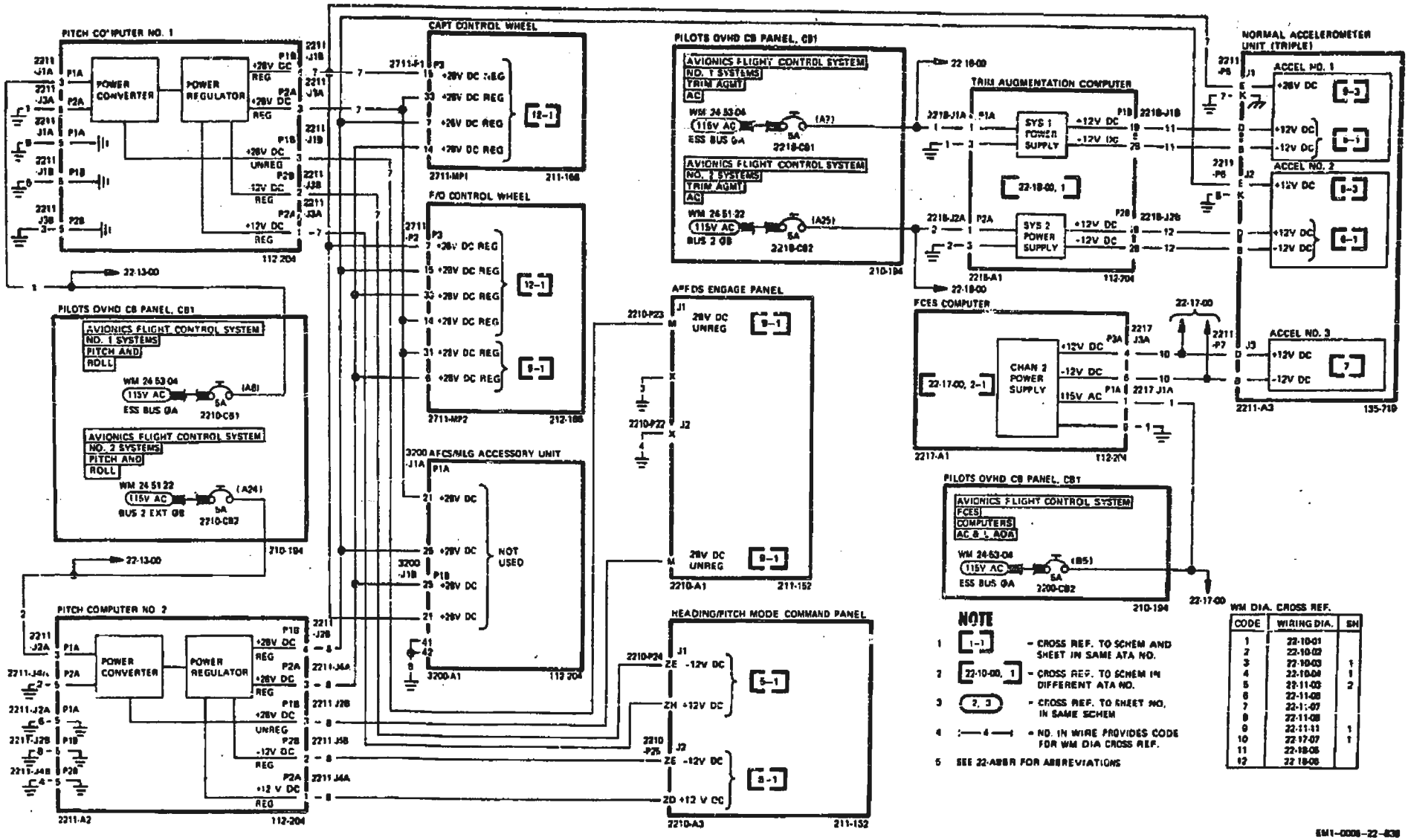
R Pitch 26 VAC Secondary Power Distribution Schematic
R SCHEM 2

EFFECTIVITY: ALL

001B



EM1-0008-22-838

R Pitch DC Secondary Power Distribution Schematic
R SCHEM 3

EFFECTIVITY: ALL

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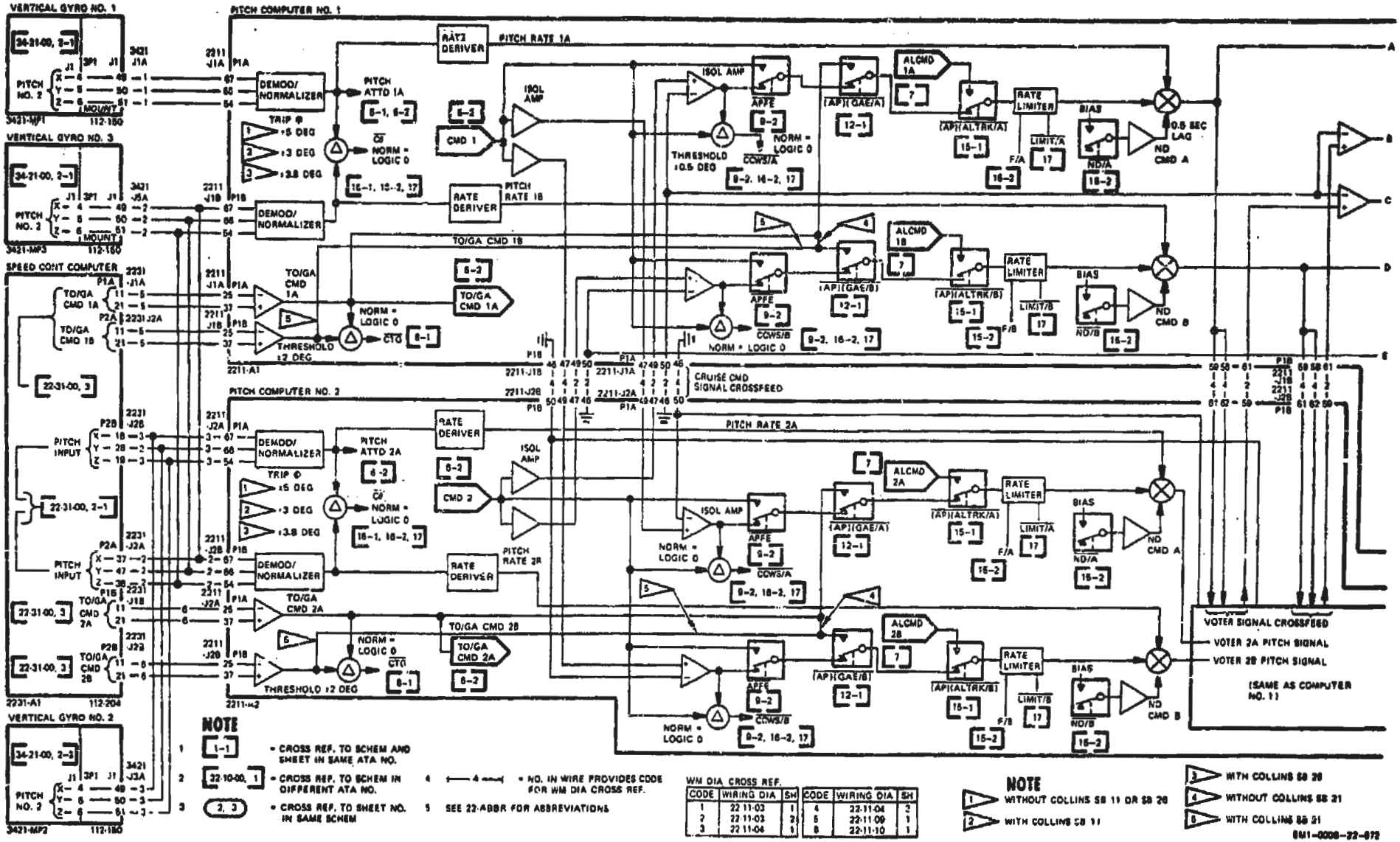
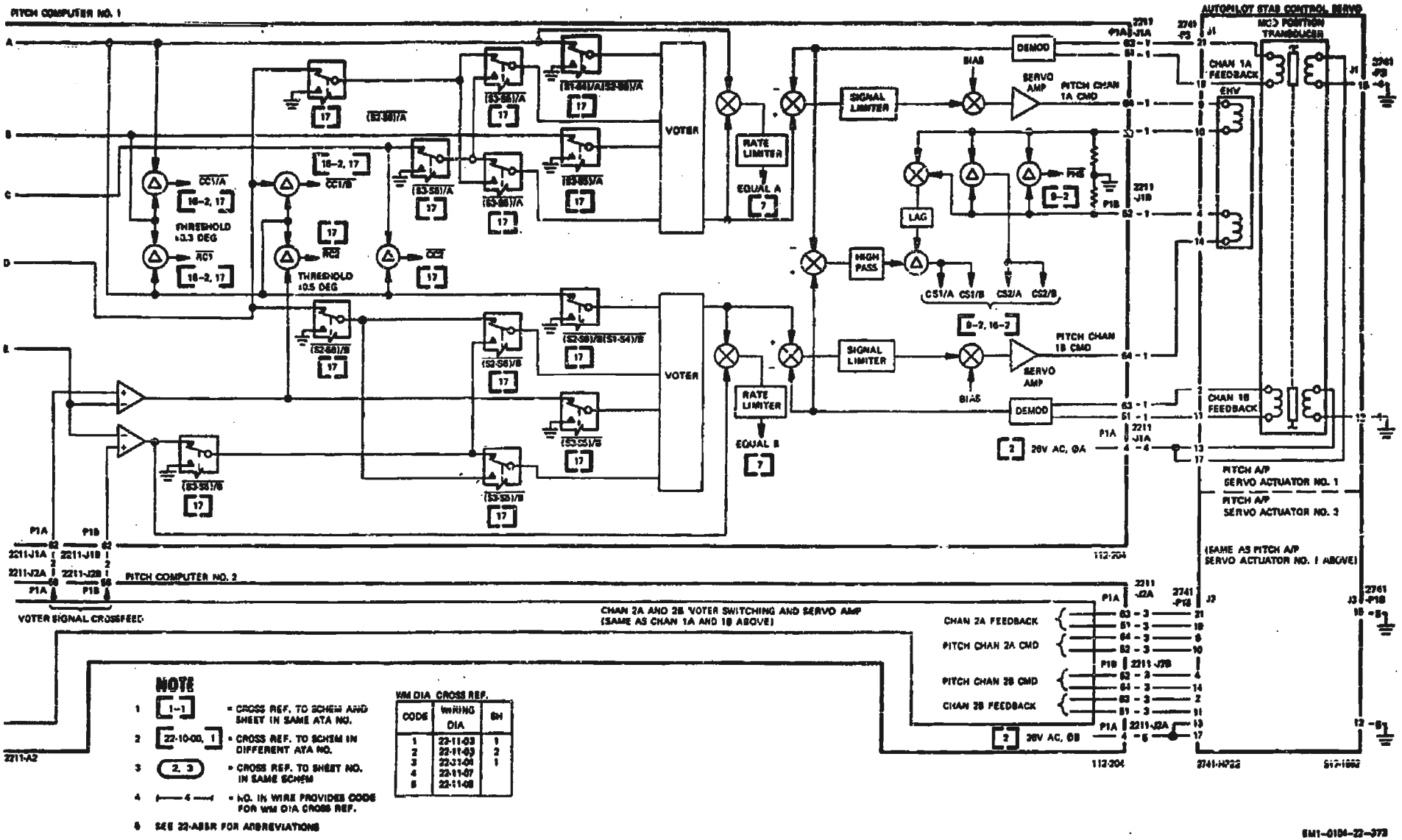


R Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode
R Signal Flow Schematic
R SCHEM 4 (Sheet 1)

EFFECTIVITY: ALL



NOTE

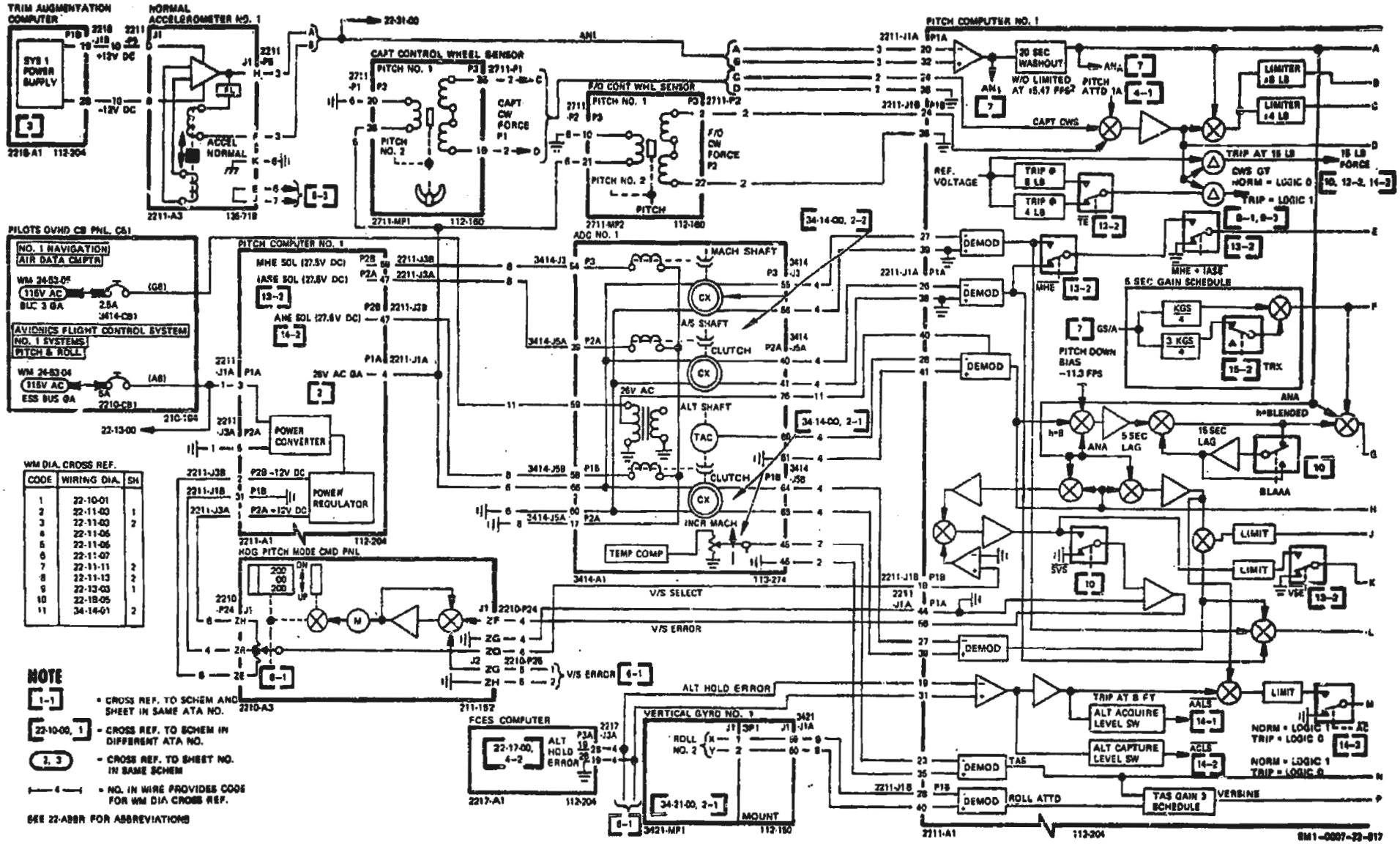
1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-11-03	1
2	22-11-03	2
3	22-31-05	1
4	22-11-07	
5	22-11-08	

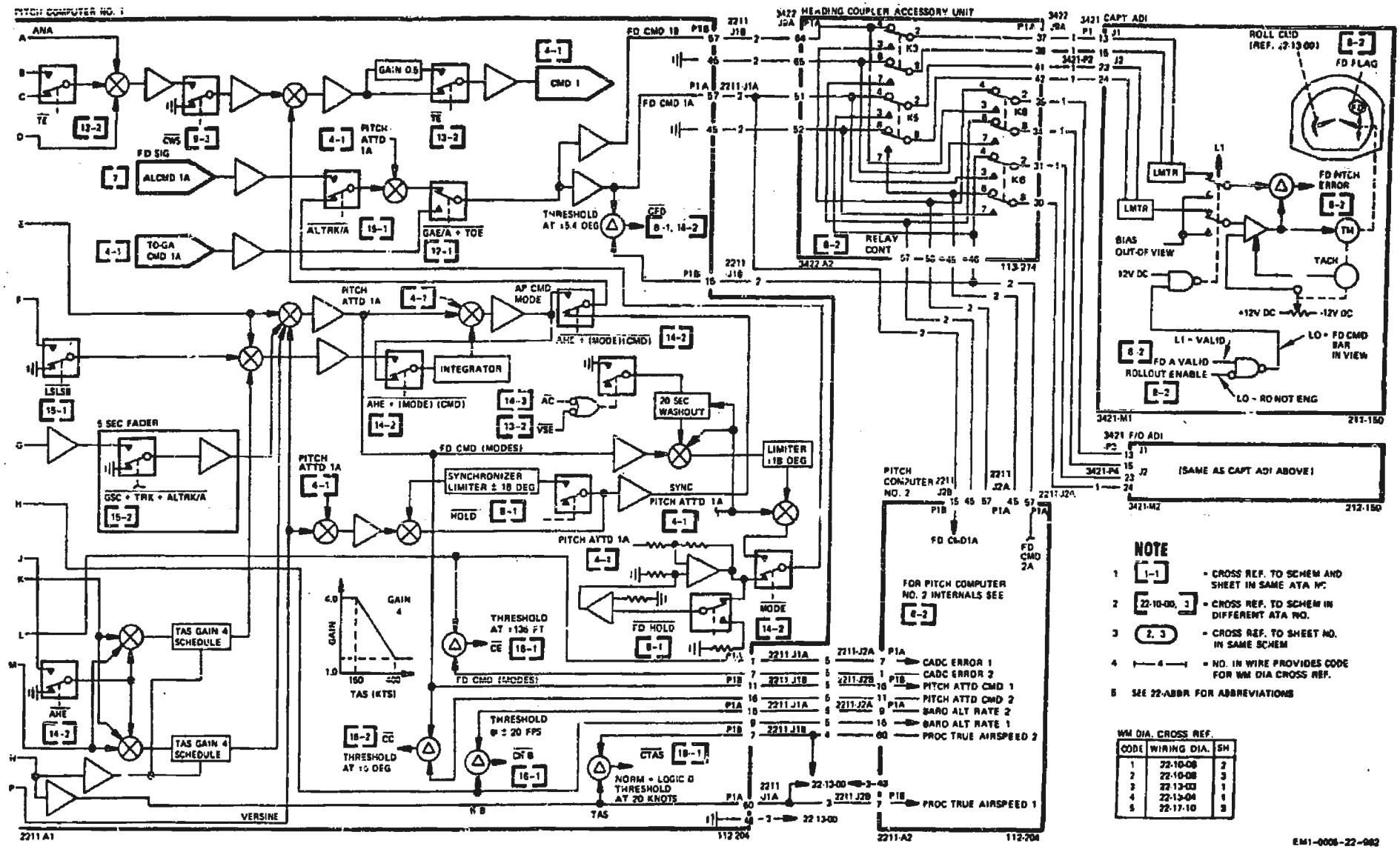
R Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode
R Signal Flow Schematic
R SCHEM 4 (Sheet 2)

EFFECTIVITY: ALL



R Pitch System No. 1 CWS/CRUISE Mode Signal Flow
R and FD Switching Schematic
R SCHEM 5 (Sheet 1)

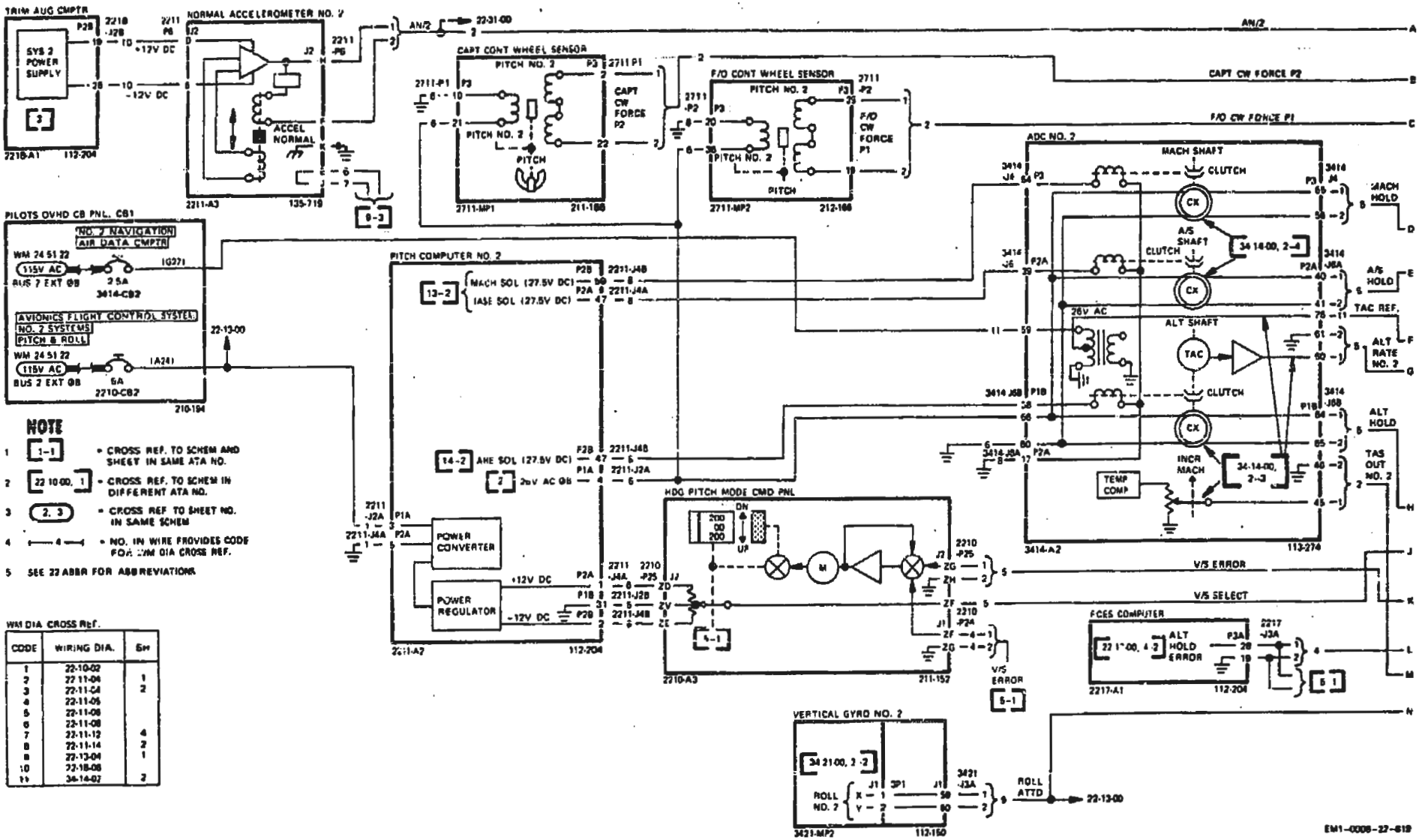
EFFECTIVITY: ALL



R Pitch System No. 1 CWS/CRUISE Mode Signal Flow
R and FD Switching Schematic
R SCHEM 5 (Sheet 2)

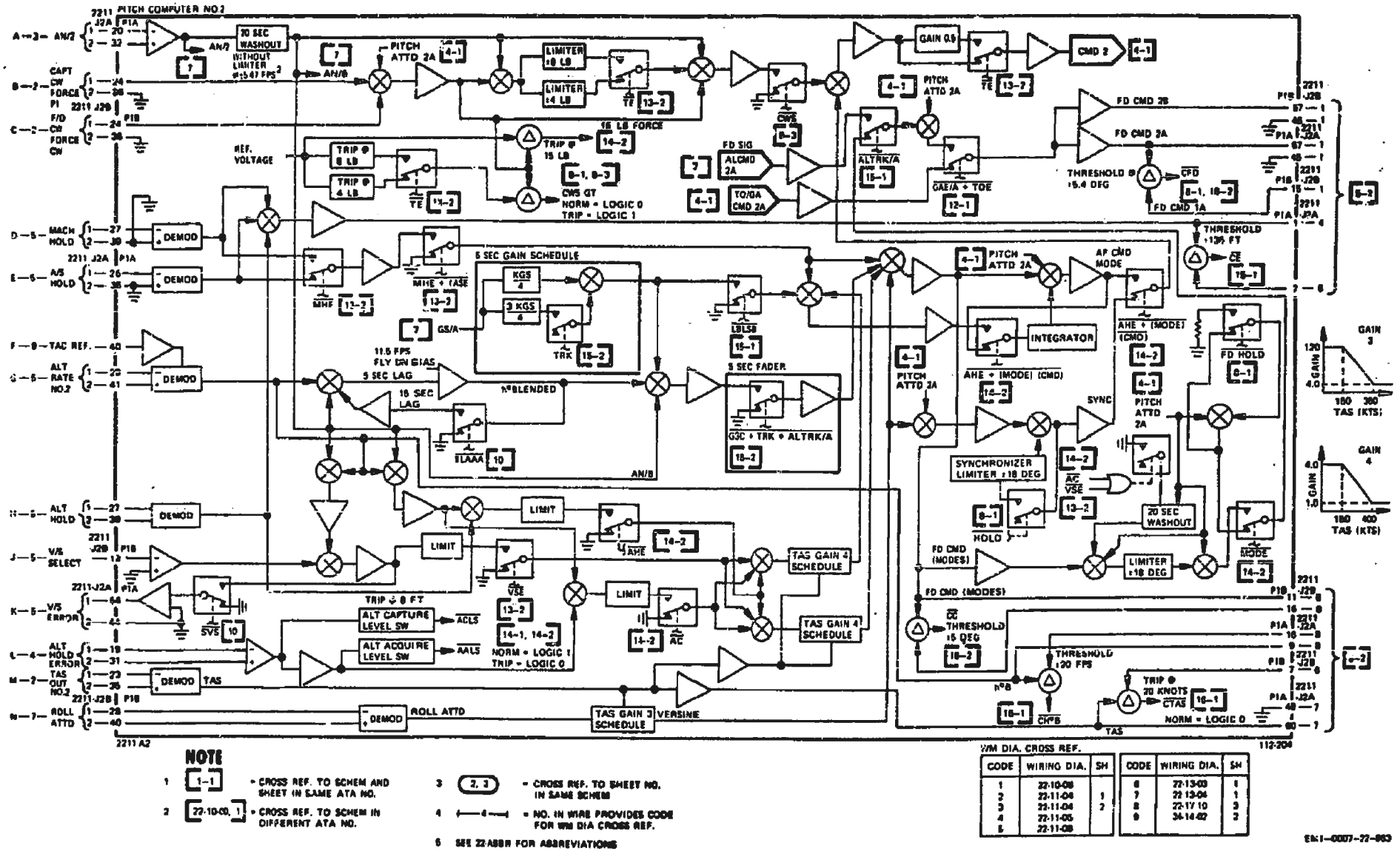
EFFECTIVITY: ALL

0018



R Pitch System No. 2 CWS/CRUISE Mode Signal Flow Schematic
R SCHEM 6 (Sheet 1)

EFFECTIVITY: ALL



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR W/M DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

W/M DIA. CROSS REF.

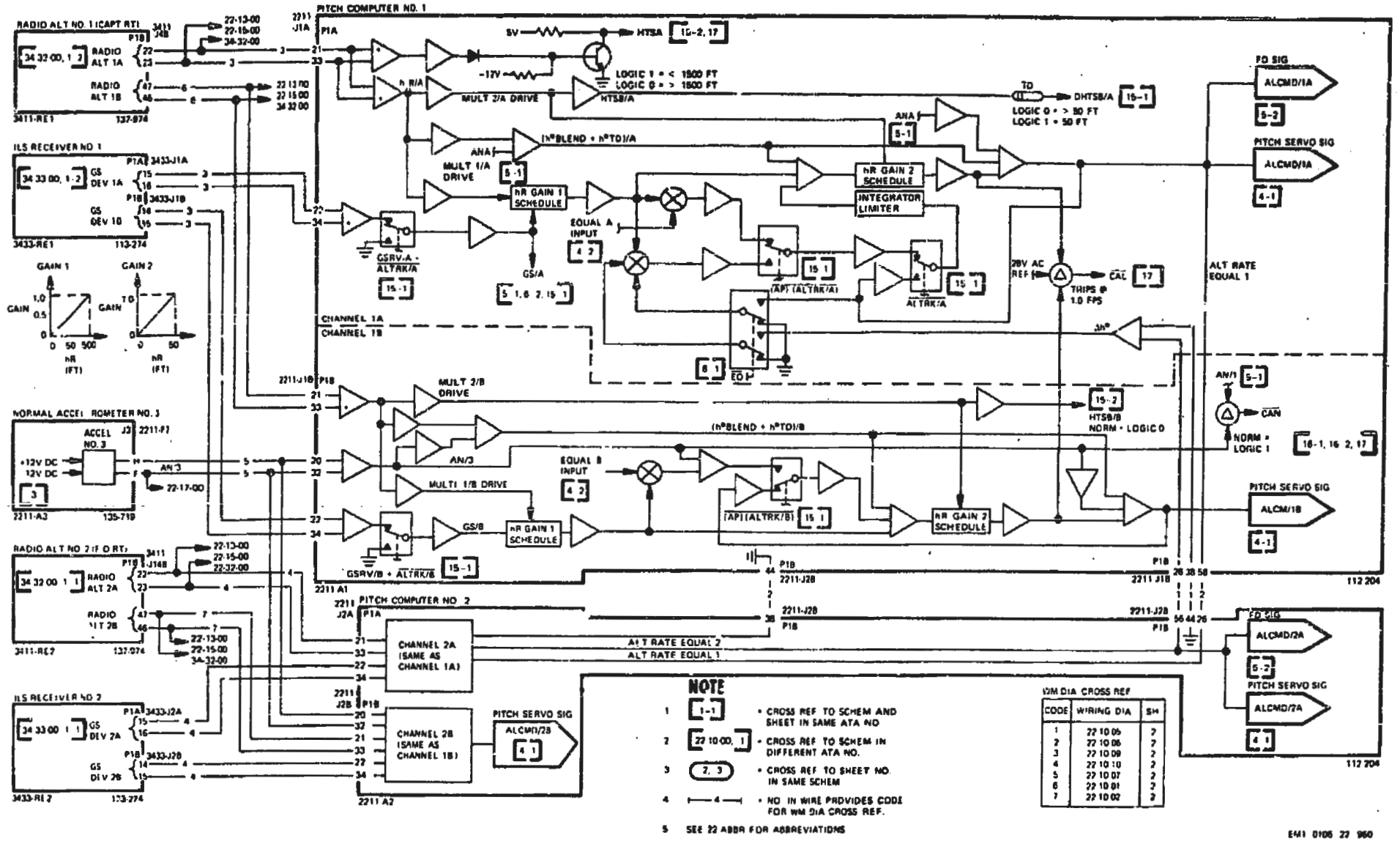
CODE	WIRING DIA.	SH	CODE	WIRING DIA.	SH
1	22-10-08		6	22-13-03	1
2	22-11-04	1	7	22-13-04	1
3	22-11-04	2	8	22-17-10	3
4	22-11-05		9	36-14-02	2
5	22-11-08				

EN:1-0007-22-083

R Pitch System No. 2 CWS/CRUISE Mode Signal Flow Schematic
R SCHEM 6 (Sheet 2)

EFFECTIVITY: ALL

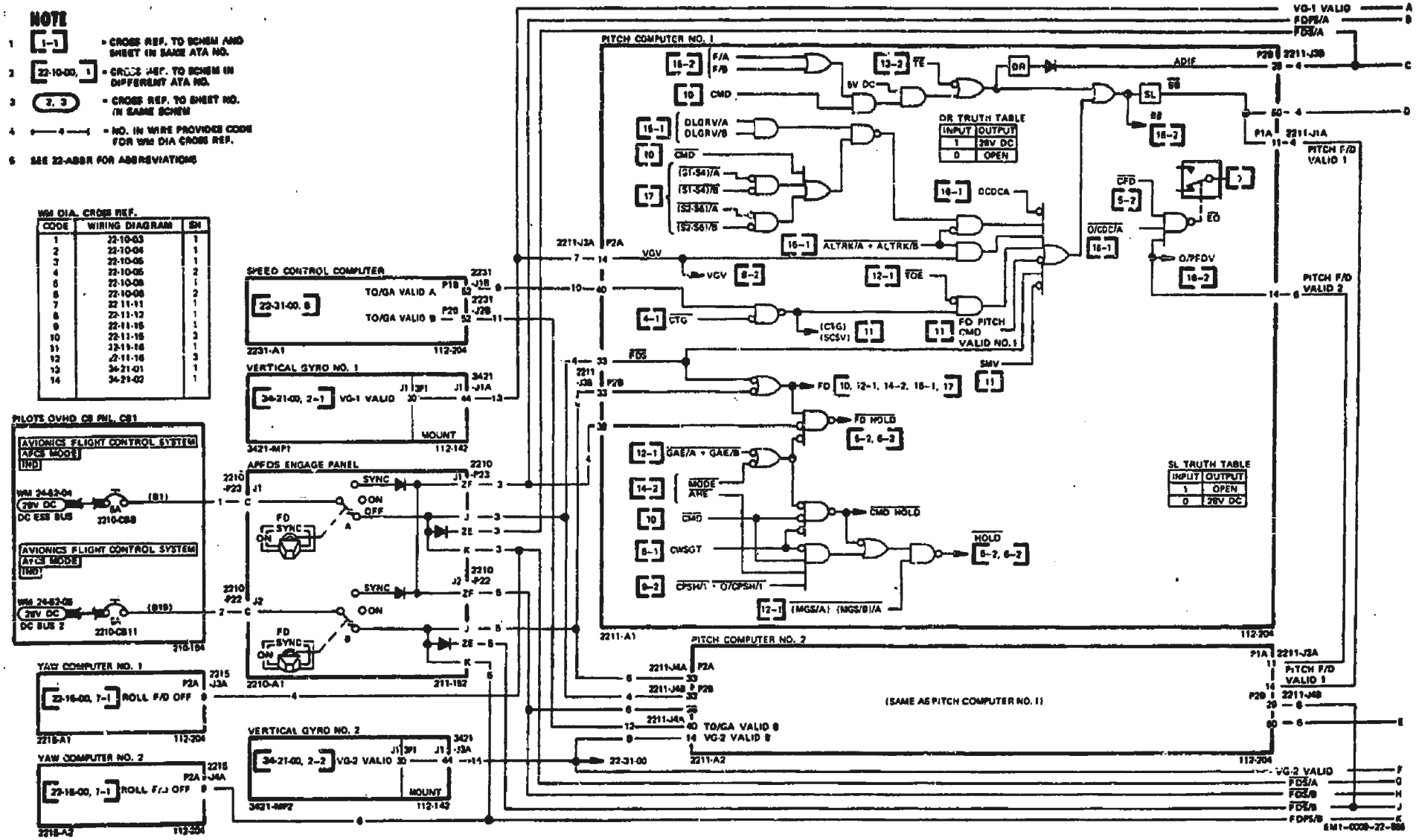
0018


PITCH COMPUTER NO. 1
RADIO ALT NO. 1 (CAPT RT)
ILS RECEIVER NO. 1
NORMAL ACCELEROMETER NO. 3
RADIO ALT NO. 2 (F/O RT)
ILS RECEIVER NO. 2
PITCH COMPUTER NO. 2
CHANNEL 1A
CHANNEL 1B
CHANNEL 2A (SAME AS CHANNEL 1A)
CHANNEL 2B (SAME AS CHANNEL 1B)
MULT 1/A DRIVE
MULT 2/A DRIVE
MULT 1/B DRIVE
MULT 2/B DRIVE
hR GAIN 1 SCHEDULE
hR GAIN 2 SCHEDULE
INTEGRATOR LIMITER
EQUAL A INPUT
EQUAL B INPUT
GSRV/A - ALTRK/A
GSRV/B - ALTRK/B
(hR BLEND + hR TDI)A
(hR BLEND + hR TDI)B
HTSA
HTSB/A
HTSB/B
DHTSB/A
ALT RATE EQUAL 1
ALT RATE EQUAL 2
PITCH SERVO SIG
FD SIG
ALCMD/1A
ALCMD/2A
ALCMD/1B
ALCMD/2B
LOGIC 1 = < 1500 FT
LOGIC 0 = > 1500 FT
LOGIC 0 = > 50 FT
LOGIC 1 = 50 FT
TRIPS @ 1.0 FPS
NORM = LOGIC 1
NORM = LOGIC 0
GAIN 1
GAIN 2
NOTE
1 [1-1] • CROSS REF TO SCHEM AND SHEET IN SAME ATA NO
2 [22 10 00, 1] • CROSS REF TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) • CROSS REF TO SHEET NO. IN SAME SCHEM
4 —4— • NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22 ABBR FOR ABBREVIATIONS
WM DIA CROSS REF
CODE | WIRING DIA | SH
1 | 22 10 06 | 2
2 | 22 10 06 | 2
3 | 22 10 09 | 2
4 | 22 10 10 | 2
5 | 22 10 07 | 2
6 | 22 10 01 | 2
7 | 22 10 02 | 2
E41 0106 22 960

R Pitch Systems No. 1 and No. 2 ALTRK Mode Signal Flow Schematic
R SCHEM 7

EFFECTIVITY: ALL

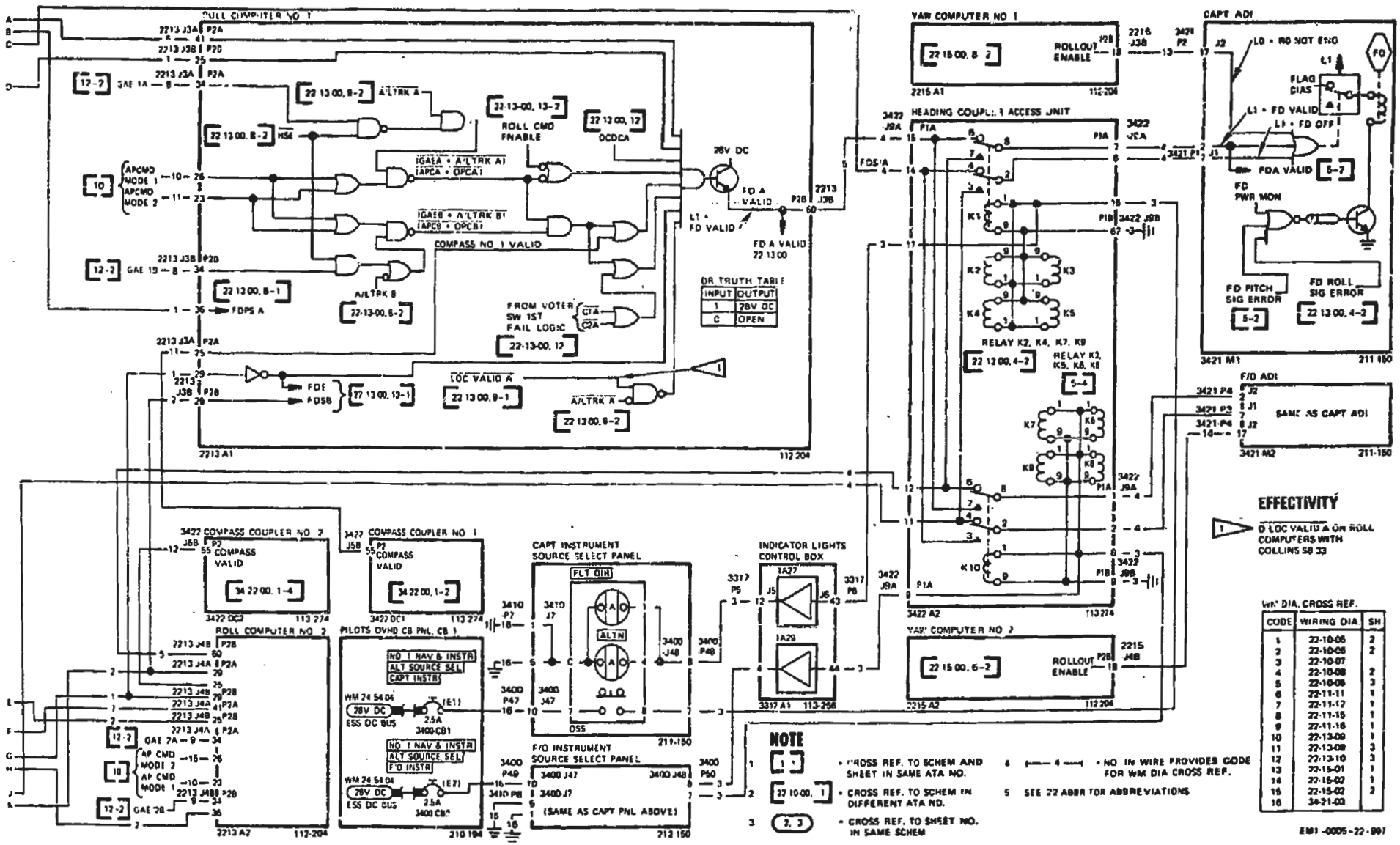
001B



R FD Mode Engage Logic and FD Switching Schematic
R SCHEM 8 (Sheet 1)

EFFECTIVITY: ALL

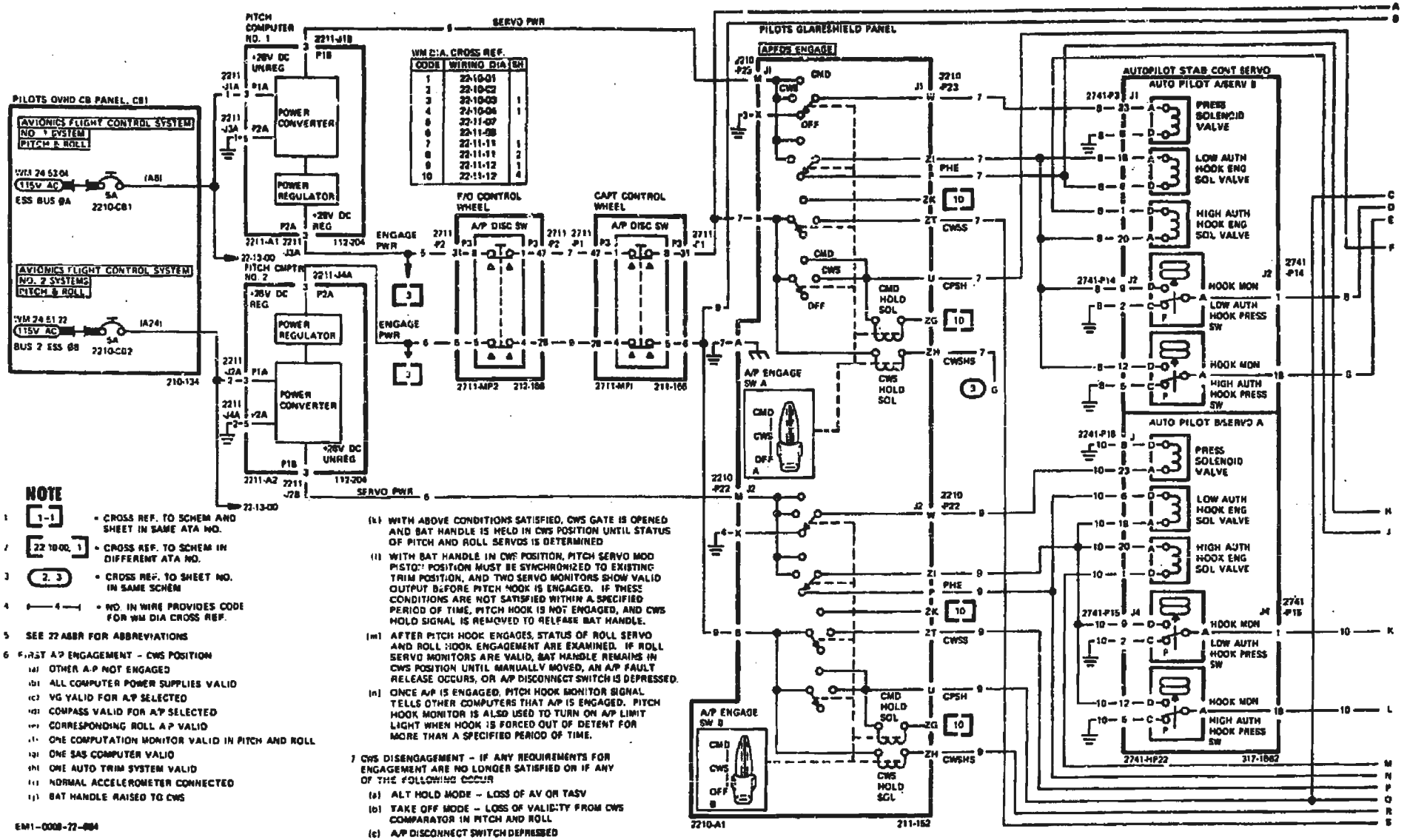
001B



R FD Mode Engage Logic and FD Switching Schematic
R SCHEM 8 (Sheet 2)

EFFECTIVITY: ALL

0018



NOTE

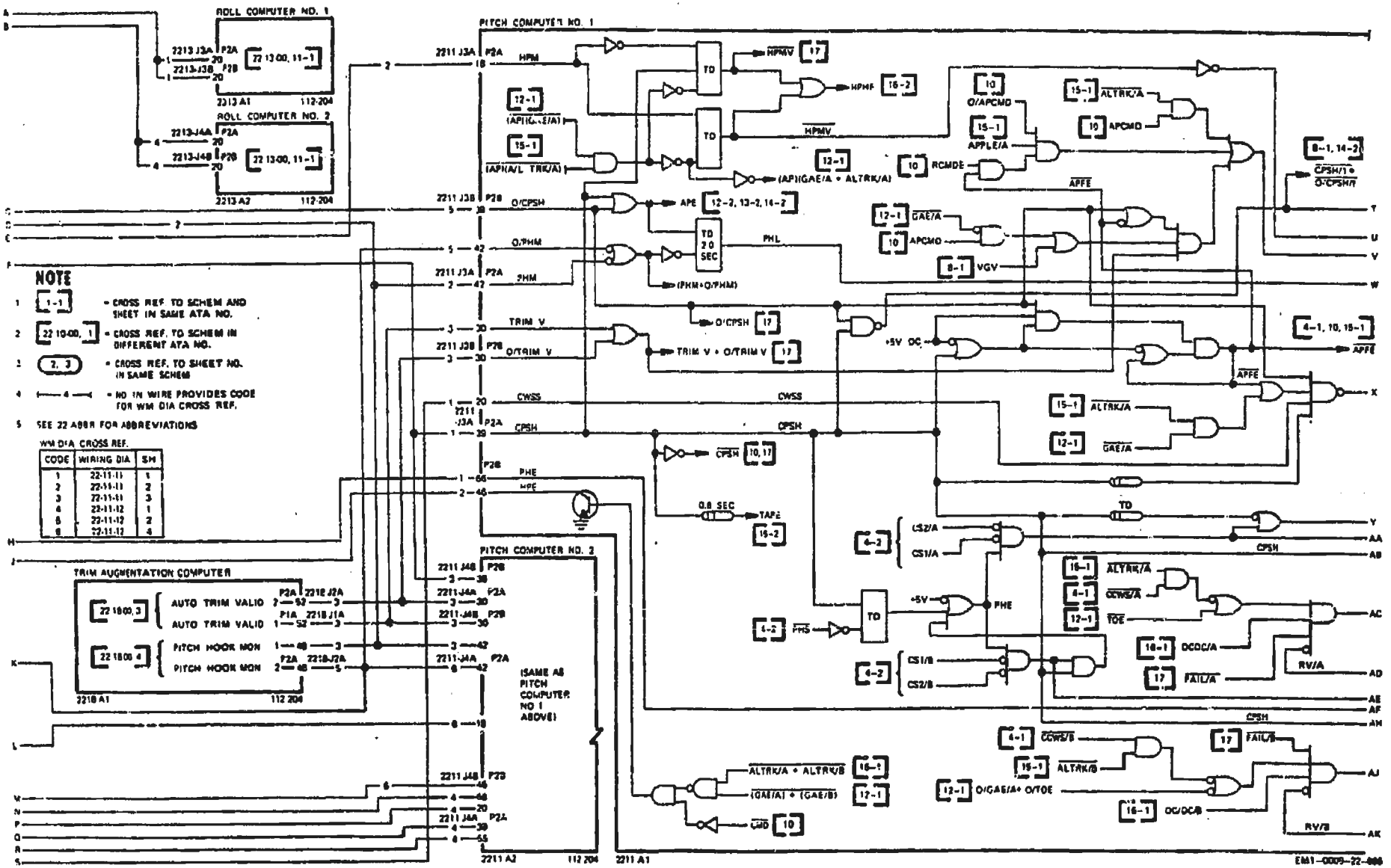
1. [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22 10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22 ABBR FOR ABBREVIATIONS
6. FIRST A/P ENGAGEMENT - CWS POSITION
   - (a) OTHER A/P NOT ENGAGED
   - (b) ALL COMPUTER POWER SUPPLIES VALID
   - (c) VG VALID FOR A/P SELECTED
   - (d) COMPASS VALID FOR A/P SELECTED
   - (e) CORRESPONDING ROLL A/P VALID
   - (f) ONE COMPUTATION MONITOR VALID IN PITCH AND ROLL
   - (g) ONE SAS COMPUTER VALID
   - (h) ONE AUTO TRIM SYSTEM VALID
   - (i) NORMAL ACCELEROMETER CONNECTED
   - (j) BAT HANDLE RAISED TO CWS
   - (k) WITH ABOVE CONDITIONS SATISFIED, CWS GATE IS OPENED AND BAT HANDLE IS HELD IN CWS POSITION UNTIL STATUS OF PITCH AND ROLL SERVOS IS DETERMINED
   - (l) WITH BAT HANDLE IN CWS POSITION, PITCH SERVO MOD PISTON POSITION MUST BE SYNCHRONIZED TO EXISTING TRIM POSITION, AND TWO SERVO MONITORS SHOW VALID OUTPUT BEFORE PITCH HOOK IS ENGAGED. IF THESE CONDITIONS ARE NOT SATISFIED WITHIN A SPECIFIED PERIOD OF TIME, PITCH HOOK IS NOT ENGAGED, AND CWS HOLD SIGNAL IS REMOVED TO RELEASE BAT HANDLE.
   - (m) AFTER PITCH HOOK ENGAGES, STATUS OF ROLL SERVO AND ROLL HOOK ENGAGEMENT ARE EXAMINED. IF ROLL SERVO MONITORS ARE VALID, BAT HANDLE REMAINS IN CWS POSITION UNTIL MANUALLY MOVED, AN A/P FAULT RELEASE OCCURS, OR A/P DISCONNECT SWITCH IS DEPRESSED.
   - (n) ONCE A/P IS ENGAGED, PITCH HOOK MONITOR SIGNAL TELLS OTHER COMPUTERS THAT A/P IS ENGAGED. PITCH HOOK MONITOR IS ALSO USED TO TURN ON A/P LIMIT LIGHT WHEN HOOK IS FORCED OUT OF DETENT FOR MORE THAN A SPECIFIED PERIOD OF TIME.
7. CWS DISENGAGEMENT - IF ANY REQUIREMENTS FOR ENGAGEMENT ARE NO LONGER SATISFIED OR IF ANY OF THE FOLLOWING OCCUR
   - (a) ALT HOLD MODE - LOSS OF AV OR TASV
   - (b) TAKE OFF MODE - LOSS OF VALIDITY FROM CWS COMPARATOR IN PITCH AND ROLL
   - (c) A/P DISCONNECT SWITCH DEPRESSED

EM1-0009-72-884

R CWS Mode Engage Logic Schematic
R SCHEM 9 (Sheet 1)

EFFECTIVITY: ALL

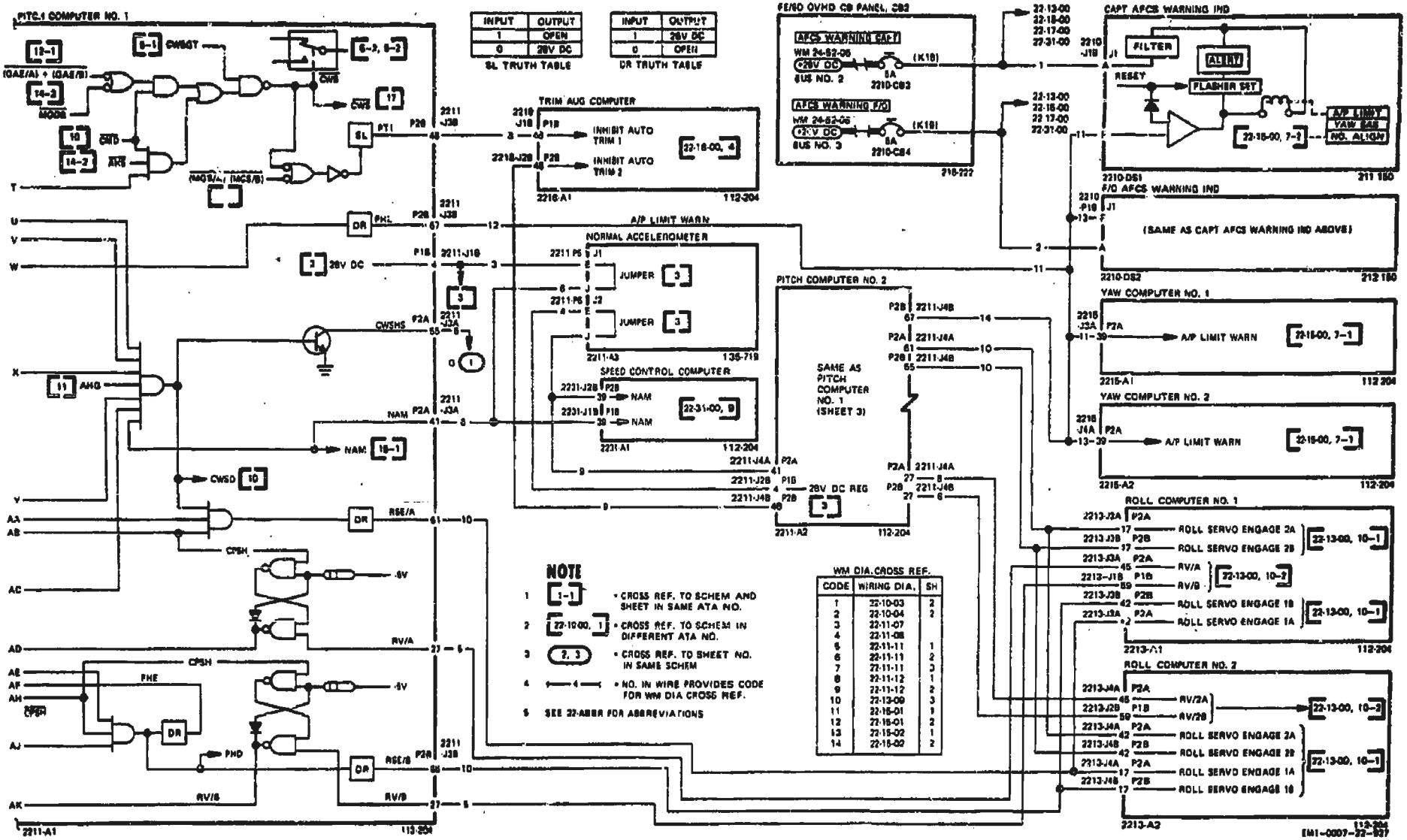
0018



R CWS Mode Engage Logic Schematic
R SCHEM 9 (Sheet 2)

EFFECTIVITY: ALL

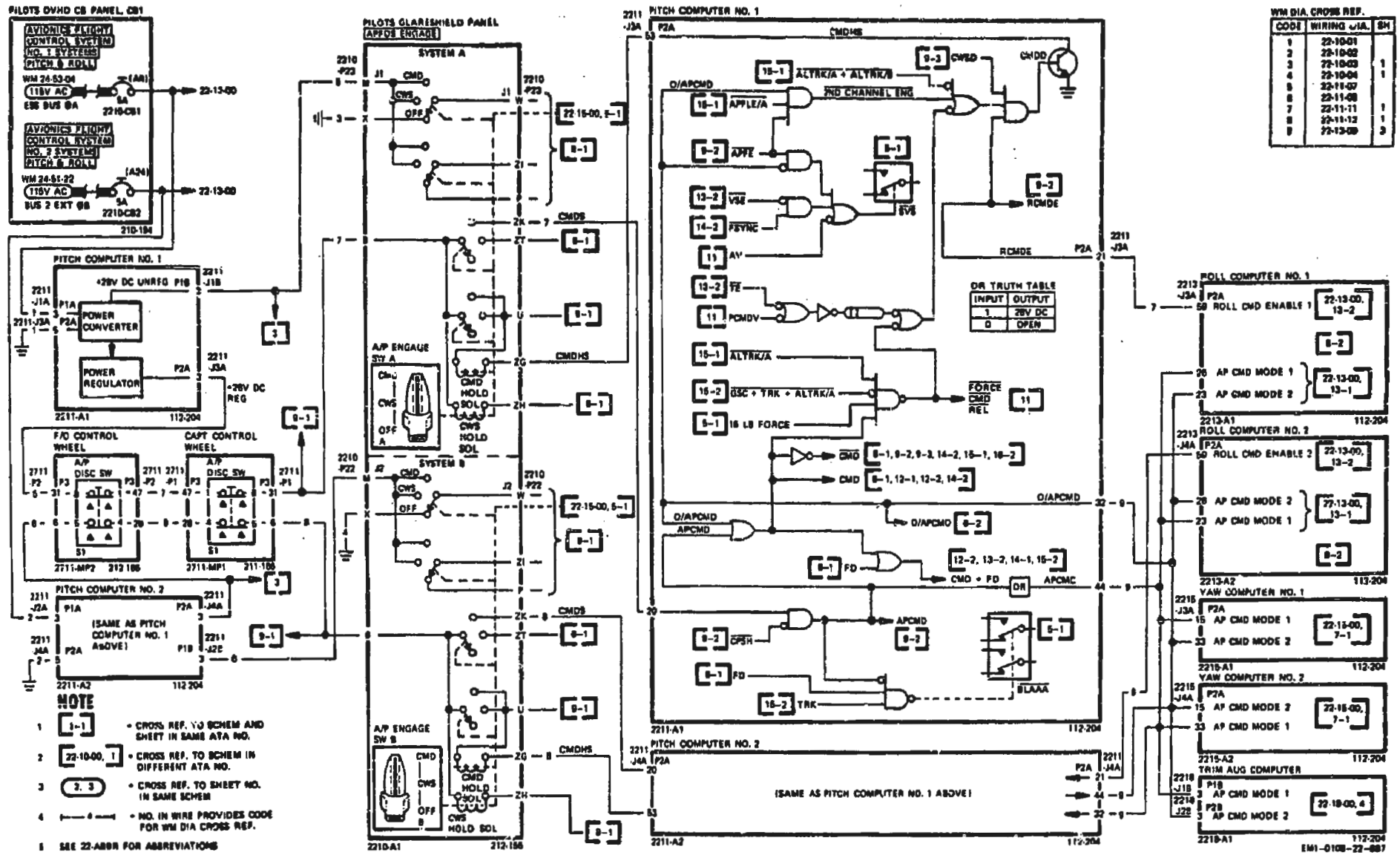
0018



R CWS Mode Engage Logic Schematic
R SCHEM 9 (Sheet 3)

EFFECTIVITY: ALL

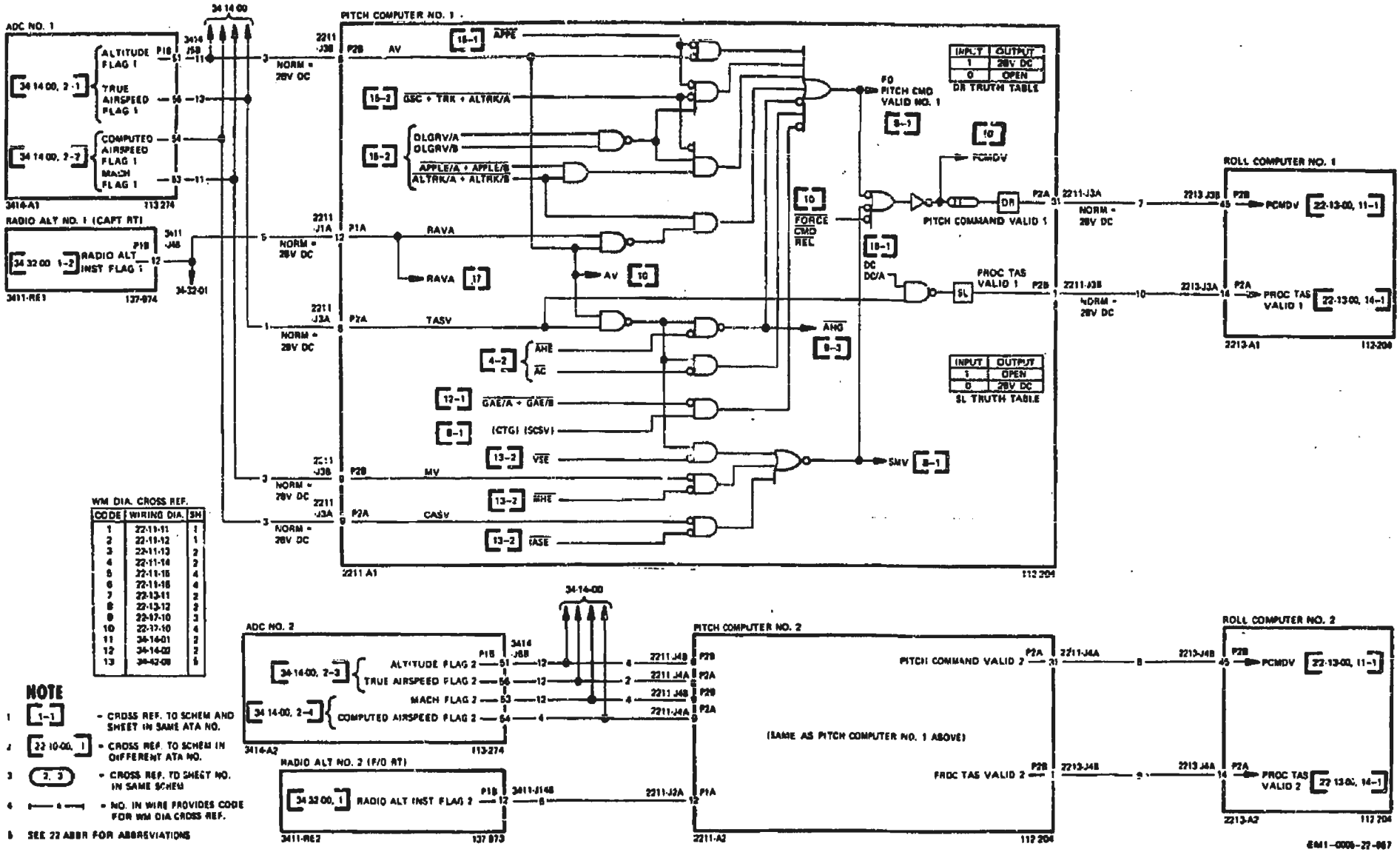
001B



CMD Mode Engage Logic Schematic
SCHEM 10

EFFECTIVITY: ALL

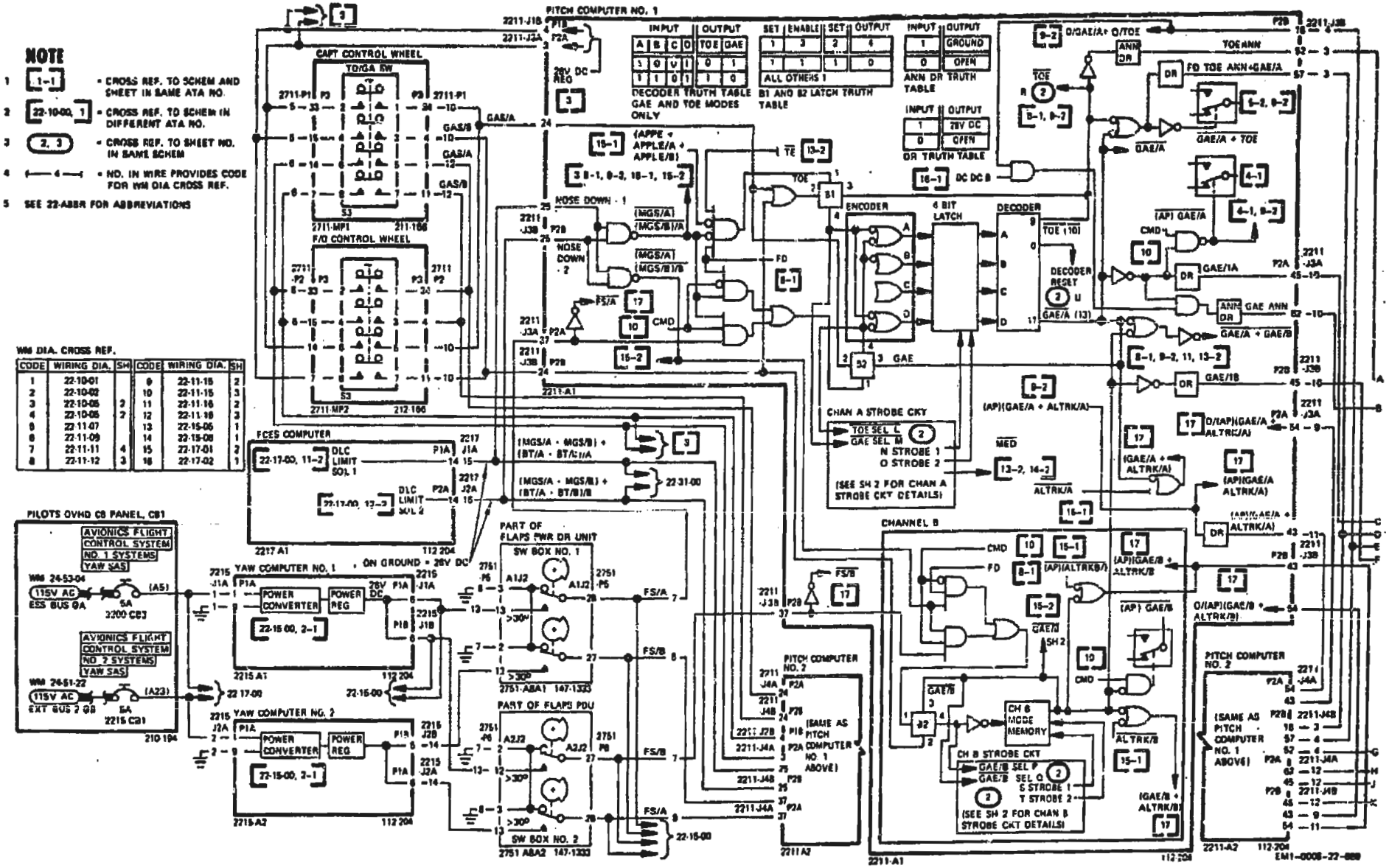
0018



R Pitch Command Valid Logic Schematic
R SCHEM 11

EFFECTIVITY: ALL

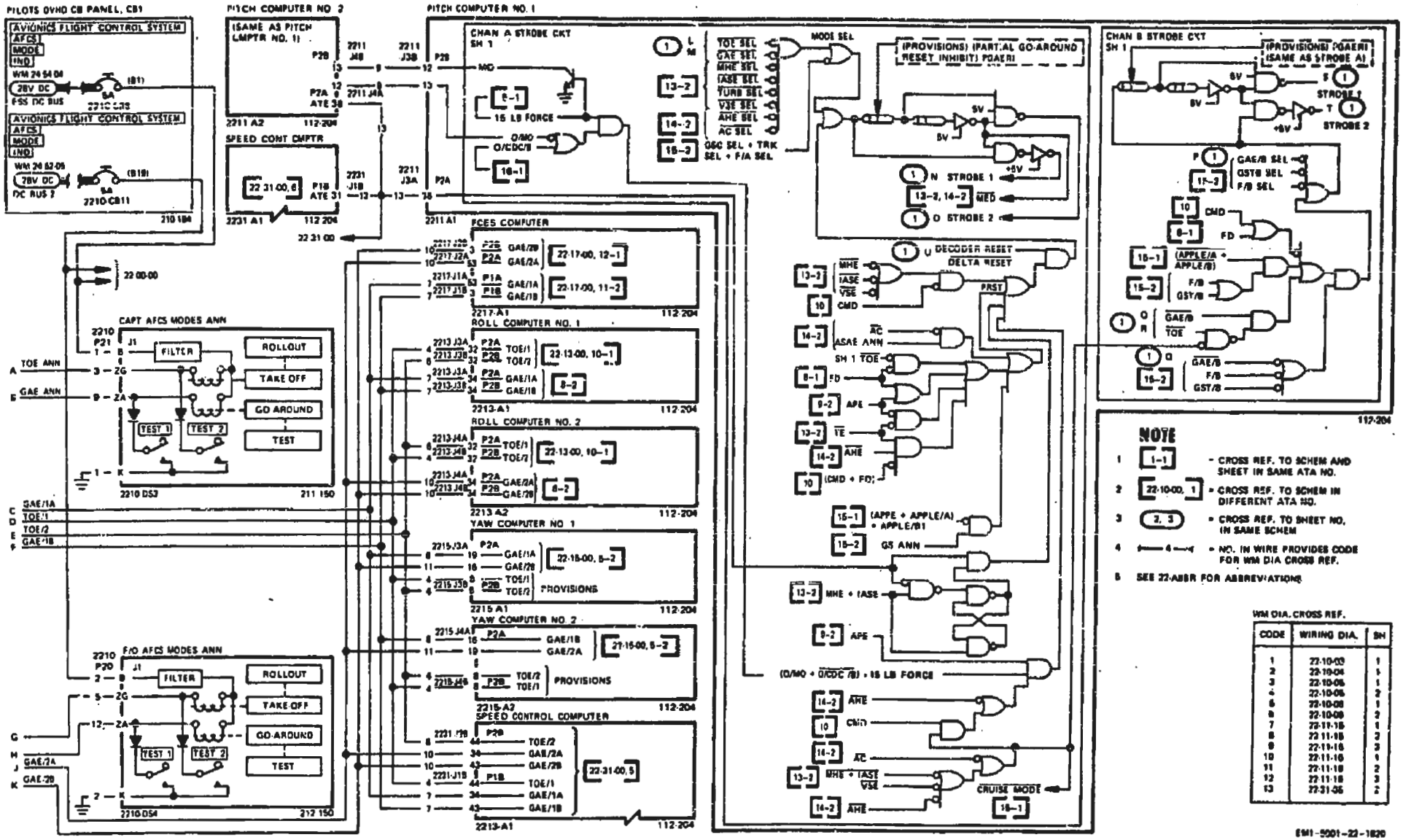
001B


NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA. CROSS REF.
PITCH COMPUTER NO. 1
CAPT CONTROL WHEEL
TO/GA SW
F/O CONTROL WHEEL
DECODER TRUTH TABLE GAE AND TOE MODES ONLY
B1 AND B2 LATCH TRUTH TABLE
ANN DR TRUTH TABLE
OR TRUTH TABLE
ENCODER
4 BIT LATCH
DECODER
CHAN A STROBE CKT
(SEE SH 2 FOR CHAN A STROBE CKT DETAILS)
CHANNEL B
CH B STROBE CKT
(SEE SH 2 FOR CHAN B STROBE CKT DETAILS)
FCES COMPUTER
PILOTS OVHD CB PANEL, CB1
AVIONICS FLIGHT CONTROL SYSTEM NO. 1 SYSTEMS YAW SAS
AVIONICS FLIGHT CONTROL SYSTEM NO. 2 SYSTEMS YAW SAS
YAW COMPUTER NO. 1
YAW COMPUTER NO. 2
PART OF FLAPS PWR DR UNIT
PART OF FLAPS PDU
SW BOX NO. 1
SW BOX NO. 2
PITCH COMPUTER NO. 2
(SAME AS PITCH COMPUTER NO. 1 ABOVE)

R Takeoff/Go-Around Modes Engage Logic Schematic
R SCHEM 12 (Sheet 1)

EFFECTIVITY: ALL

0018



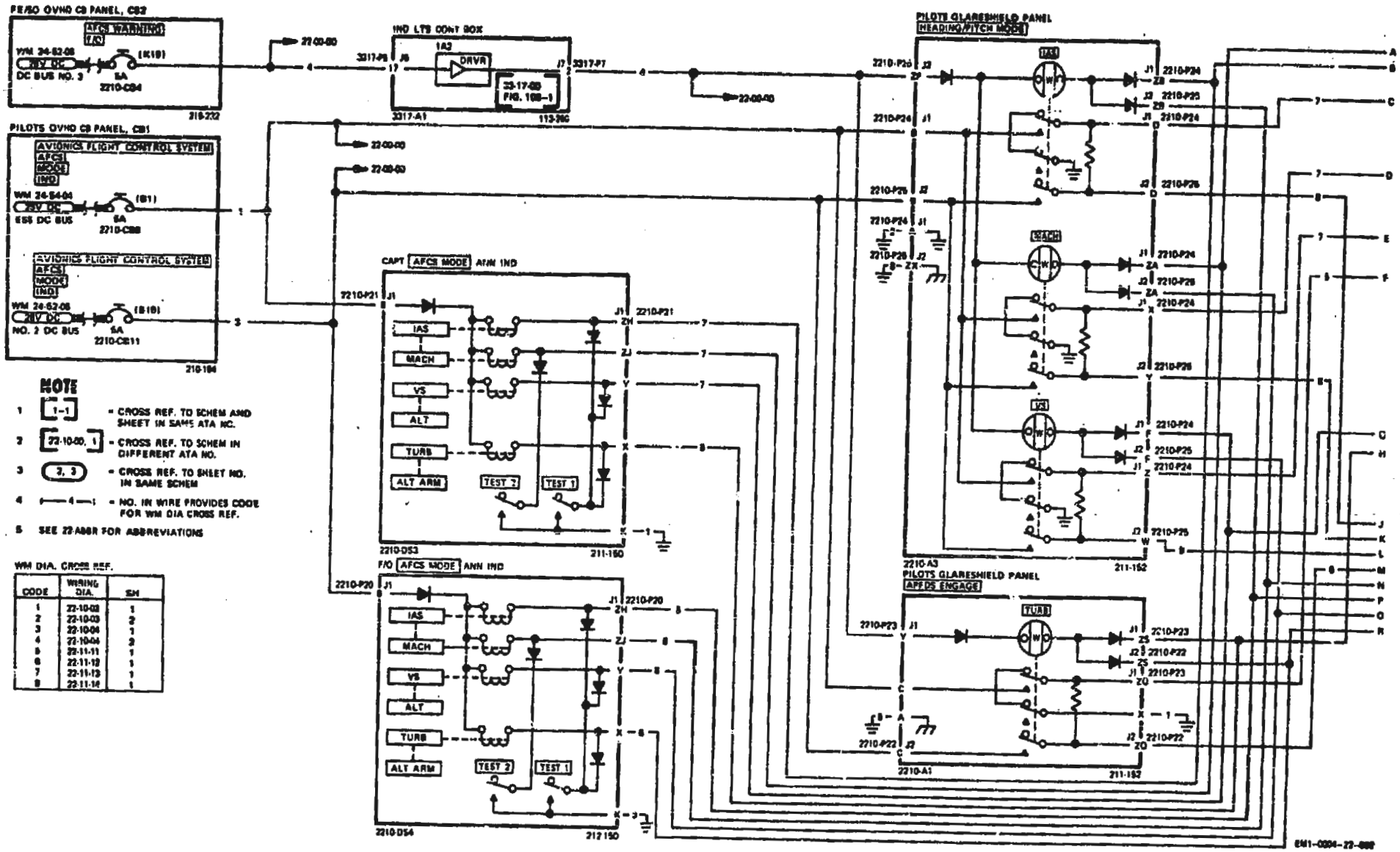
CODE	WIRING DIA.	SH
1	22-10-03	1
2	22-10-04	1
3	22-10-05	1
4	22-10-05	2
5	22-10-08	1
6	22-10-08	2
7	22-11-15	1
8	22-11-15	2
9	22-11-15	3
10	22-11-16	1
11	22-11-16	2
12	22-11-16	3
13	22-31-05	2

EMI-5001-22-1820

R Takeoff/Go-Around Modes Engage Logic Schematic
R SCHEM 12 (Sheet 2)

EFFECTIVITY: ALL

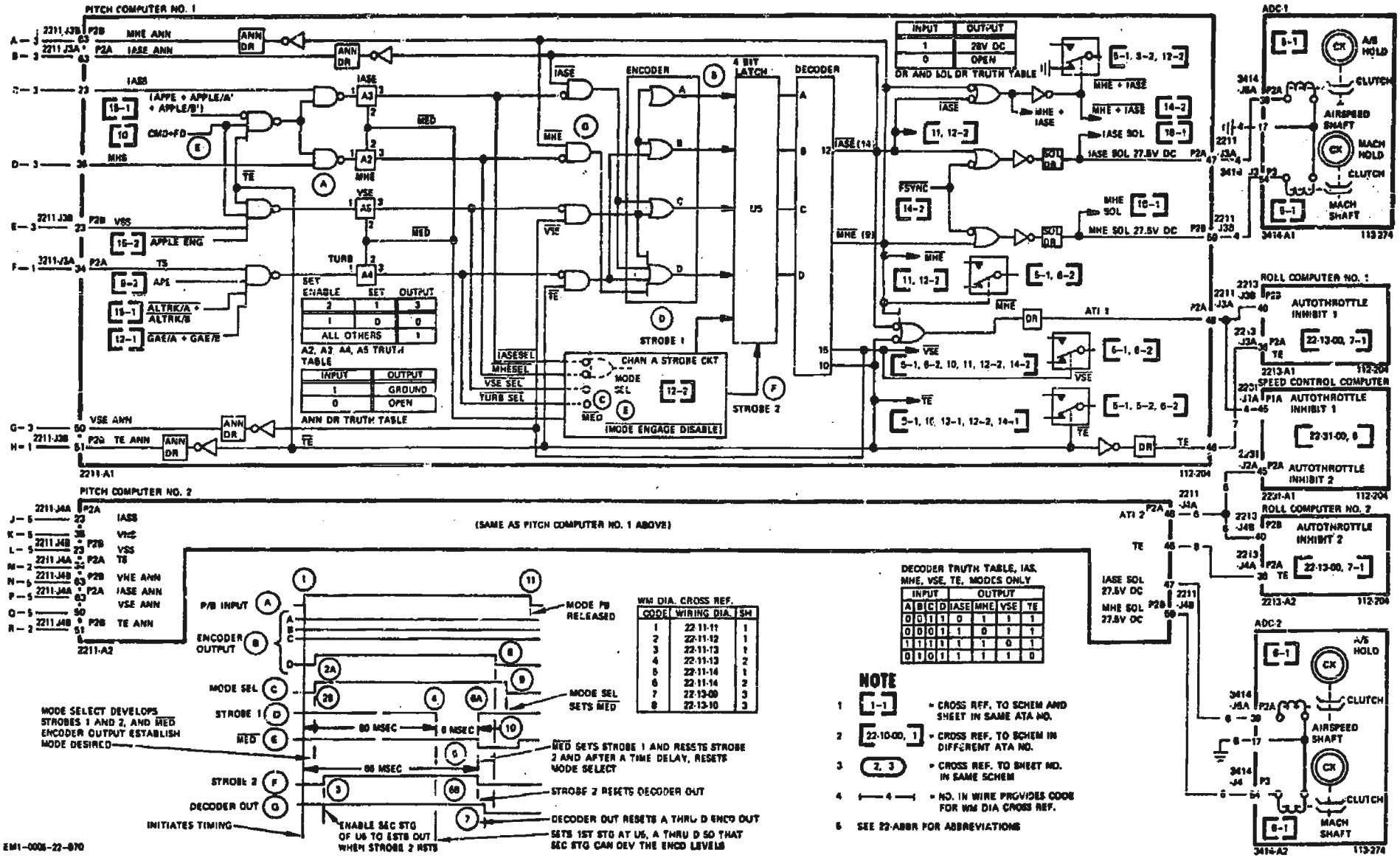
0018



R Turbulence, Vertical Speed, Indicated Air Speed and
R Mach Hold Engage Logic Schematic
R SCHEM 13 (Sheet 1)

EFFECTIVITY: ALL

0018


PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
(SAME AS PITCH COMPUTER NO. 1 ABOVE)
ENCODER
4 BIT LATCH
DECODER
U5
STROBE 1
STROBE 2
CHAN A STROBE CKT
MODE SEL
MED
(MODE ENGAGE DISABLE)
ANN DR TRUTH TABLE
OR AND SOL DR TRUTH TABLE
DECODER TRUTH TABLE, IAS, MHE, VSE, TE, MODES ONLY
ADC 1
ADC 2
ROLL COMPUTER NO. 1
ROLL COMPUTER NO. 2
SPEED CONTROL COMPUTER
AUTOTHROTTLE INHIBIT 1
AUTOTHROTTLE INHIBIT 2
AIRSPEED SHAFT
MACH SHAFT
CLUTCH
A/S HOLD
MACH HOLD
MODE SELECT DEVELOPS STROBES 1 AND 2, AND MED ENCODER OUTPUT ESTABLISH MODE DESIRED
INITIATES TIMING
ENABLE SEC STG OF U6 TO ESTB OUT WHEN STROBE 2 RSTS
MODE SEL SETS MED
MED SETS STROBE 1 AND RESETS STROBE 2 AND AFTER A TIME DELAY, RESETS MODE SELECT
STROBE 2 RESETS DECODER OUT
DECODER OUT RESETS A THRU D ENCD OUT
SETS 1ST STG AT U5, A THRU D SO THAT SEC STG CAN DEV THE ENCD LEVELS
NOTE
1 1-1 = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 22-10-00, 1 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 2, 3 = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS

SET ENABLE	SET	OUTPUT
2	1	3
1	0	0
ALL OTHERS		1

A2, A3, A4, A5 TRUTH TABLE

INPUT	OUTPUT
1	GROUND
0	OPEN

INPUT	OUTPUT
1	28V DC
0	OPEN

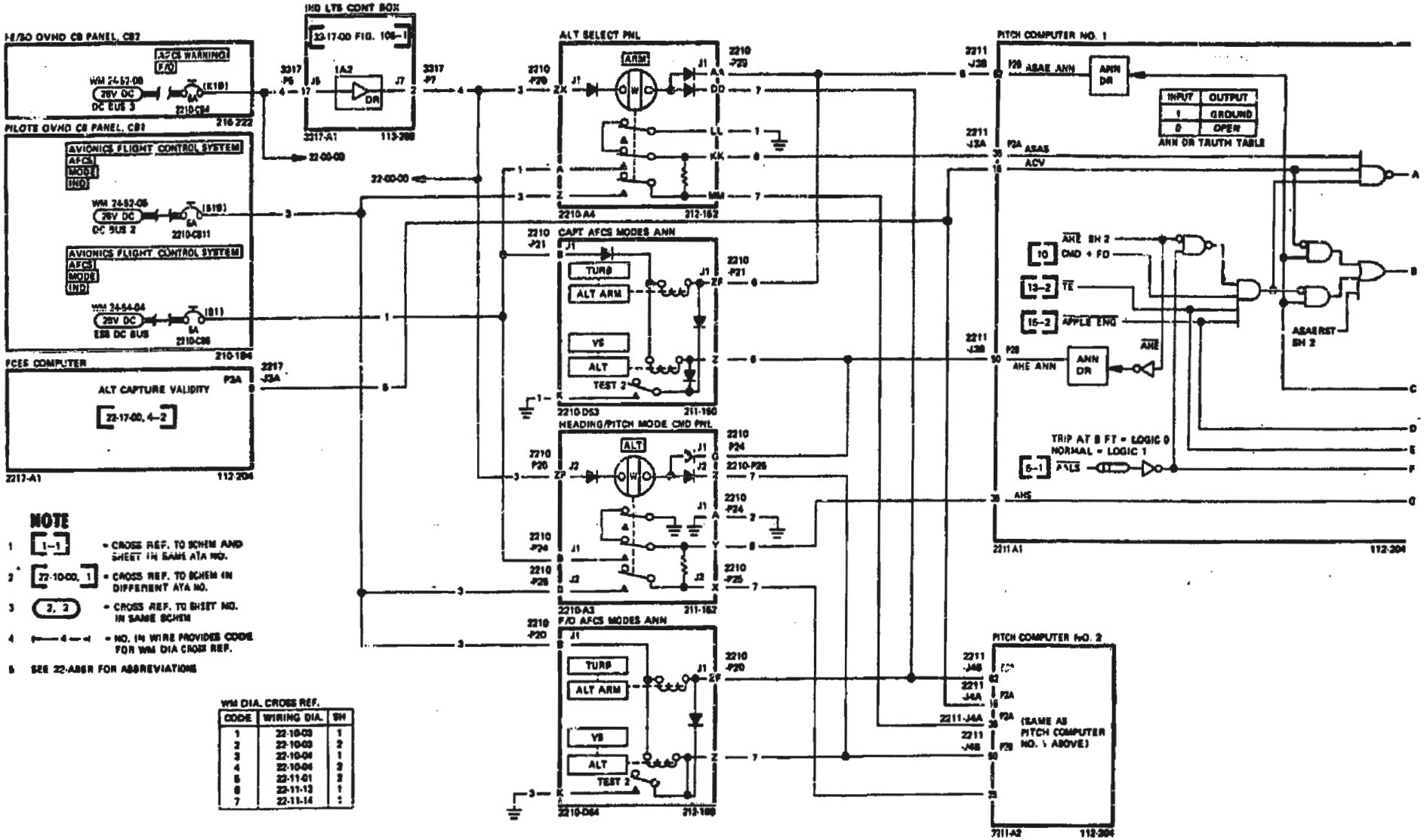
WM DIA. CROSS REF.		
CODE	WIRING DIA.	SH
1	22-11-11	1
2	22-11-12	1
3	22-11-13	1
4	22-11-13	2
5	22-11-14	1
6	22-11-14	2
7	22-13-09	3
8	22-13-10	3

INPUT				OUTPUT			
A	B	C	D	IASE	MHE	VSE	TE
0	0	1	1	0	1	1	1
0	0	0	1	1	0	1	1
1	1	1	1	1	1	0	1
0	1	0	1	1	1	1	0

R R R Turbulence, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic Schematic
SCHEM 13 (Sheet 2)

EFFECTIVITY: ALL

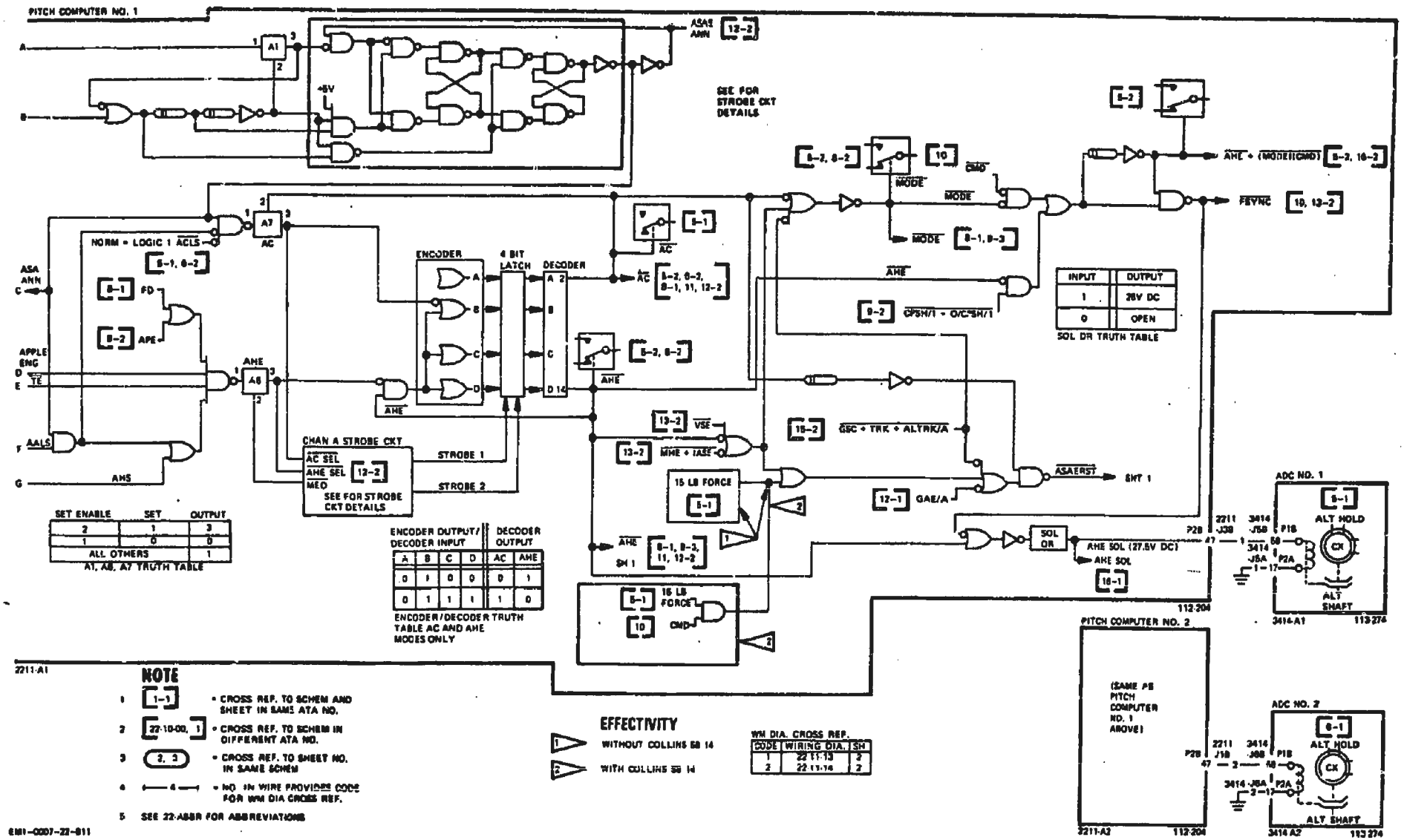
001B



R Altitude Arm, Capture, and Hold Mode Engage Logic Schematic
R SCHEM 14 (Sheet 1)

EFFECTIVITY: ALL

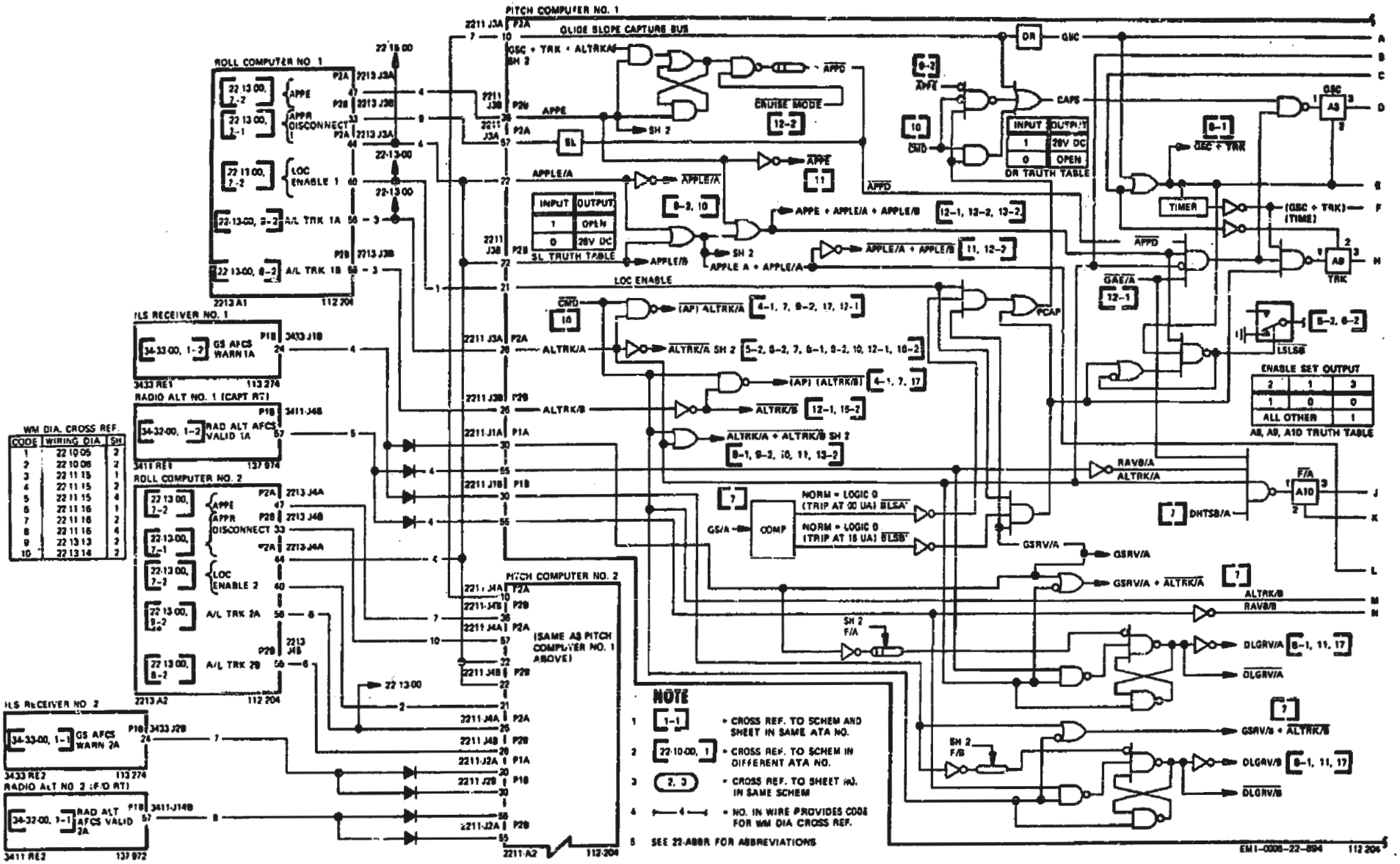
0018



R Altitude Arm, Capture, and Hold Mode Engage Logic Schematic
R SCHEM 14 (Sheet 2)

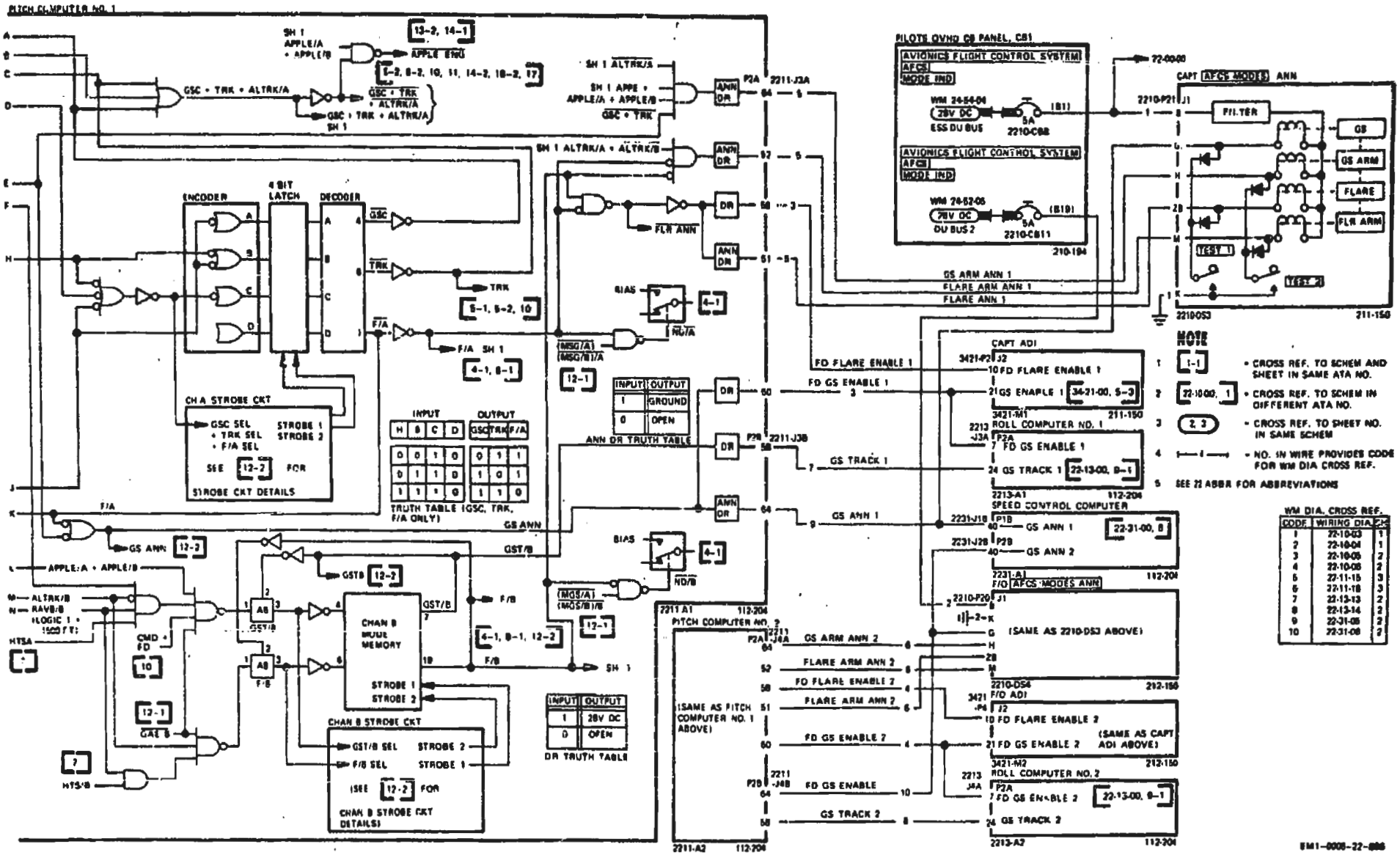
EFFECTIVITY: ALL

0018


PITCH COMPUTER NO. 1
GLIDE SLOPE CAPTURE BUS
ROLL COMPUTER NO. 1
ROLL COMPUTER NO. 2
PITCH COMPUTER NO. 2
(SAME AS PITCH COMPUTER NO. 1 ABOVE)
GLS RECEIVER NO. 1
GLS RECEIVER NO. 2
RADIO ALT NO. 1 (CAPT RT)
RADIO ALT NO. 2 (F/O RT)
WM DIA. CROSS REF.
CODE | WIRING DIA | SH
1 | 22 10 05 | 2
2 | 22 10 06 | 2
3 | 22 11 15 | 1
4 | 22 11 15 | 2
5 | 22 11 15 | 4
6 | 22 11 16 | 1
7 | 22 11 16 | 2
8 | 22 11 16 | 4
9 | 22 13 13 | 2
10 | 22 13 14 | 2
INPUT | OUTPUT
1 | OPEN
0 | 28V DC
SL TRUTH TABLE
INPUT | OUTPUT
1 | 28V DC
0 | OPEN
OR TRUTH TABLE
ENABLE SET OUTPUT
2 | 1 | 3
1 | 0 | 0
ALL OTHER | 1
A8, A9, A10 TRUTH TABLE
NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 ⟵4⟶ • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
EM1-0008-22-894 112 204

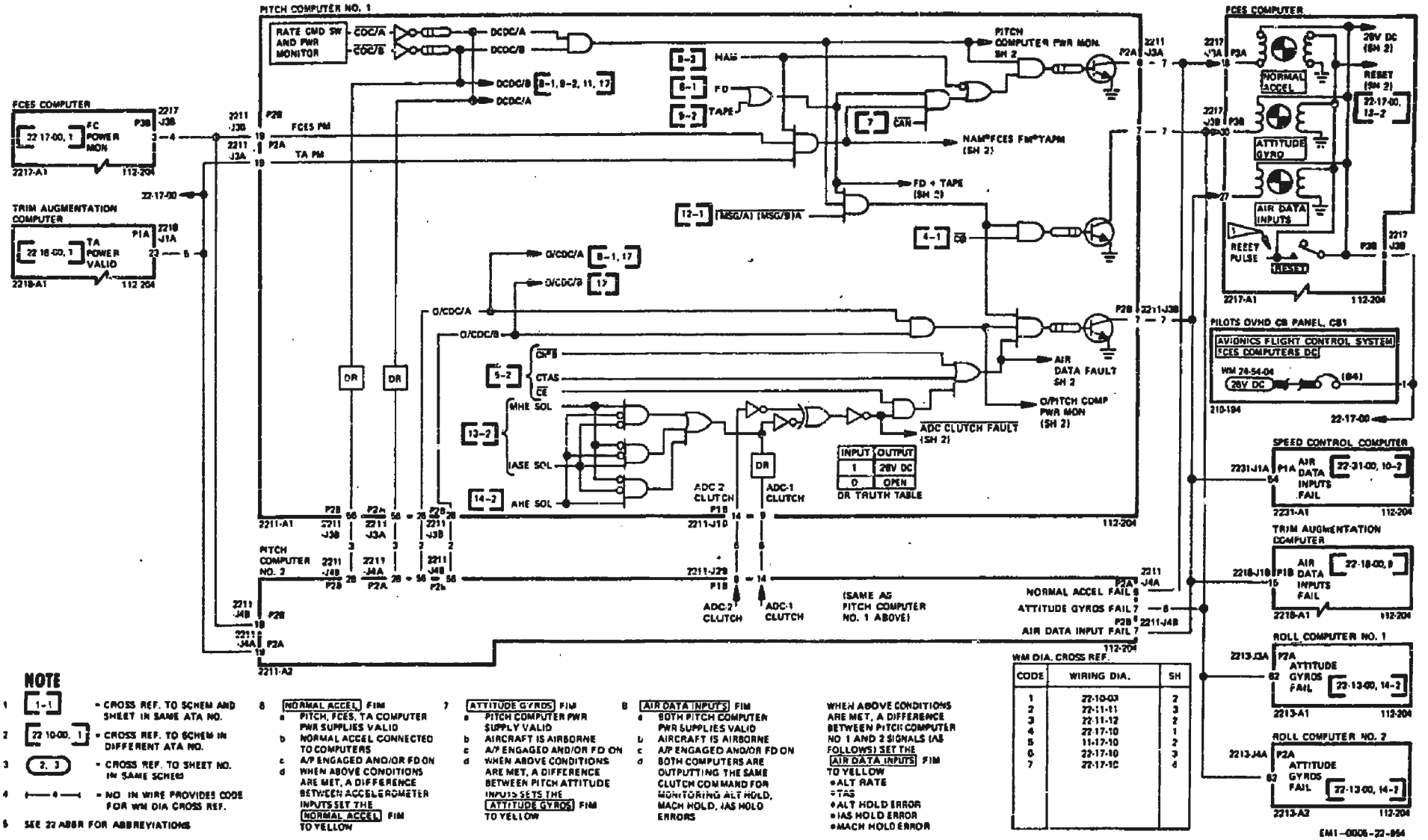
Glideslope Capture, Track, Approach Land, and Flare Engage Logic Schematic
SCHEM 15 (Sheet 1)

R
R
0018 EFFECTIVITY: ALL



Glideslope Capture, Track, Approach Land, and Flare Engage Logic Schematic
SCHEM 15 (Sheet 2)

R EFFECTIVITY: ALL
R
0018



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22 10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22 ABBR FOR ABBREVIATIONS
6. NORMAL ACCEL FIM
   a. PITCH, FCES, TA COMPUTER PWR SUPPLIES VALID
   b. NORMAL ACCEL CONNECTED TO COMPUTERS
   c. A/P ENGAGED AND/OR FD ON
   d. WHEN ABOVE CONDITIONS ARE MET, A DIFFERENCE BETWEEN ACCELEROMETER INPUTS SET THE NORMAL ACCEL FIM TO YELLOW
7. ATTITUDE GYROS FIM
   a. PITCH COMPUTER PWR SUPPLY VALID
   b. AIRCRAFT IS AIRBORNE
   c. A/P ENGAGED AND/OR FD ON
   d. WHEN ABOVE CONDITIONS ARE MET, A DIFFERENCE BETWEEN PITCH ATTITUDE INPUTS SETS THE ATTITUDE GYROS FIM TO YELLOW
8. AIR DATA INPUTS FIM
   a. BOTH PITCH COMPUTER PWR SUPPLIES VALID
   b. AIRCRAFT IS AIRBORNE
   c. A/P ENGAGED AND/OR FD ON
   d. BOTH COMPUTERS ARE OUTPUTTING THE SAME CLUTCH COMMAND FOR MONITORING ALT HOLD, MACH HOLD, IAS HOLD ERRORS

WHEN ABOVE CONDITIONS ARE MET, A DIFFERENCE BETWEEN PITCH COMPUTER NO. 1 AND 2 SIGNALS (AS FOLLOWS) SET THE AIR DATA INPUTS FIM TO YELLOW
- ALT RATE
- TAS
- ALT HOLD ERROR
- IAS HOLD ERROR
- MACH HOLD ERROR

WM DIA. CROSS REF.

CODE	WIRING DIA.	SH
1	22-10-03	2
2	22-11-11	3
3	22-11-12	2
4	22-17-10	1
5	11-17-10	2
6	22-17-10	3
7	22-17-10	4

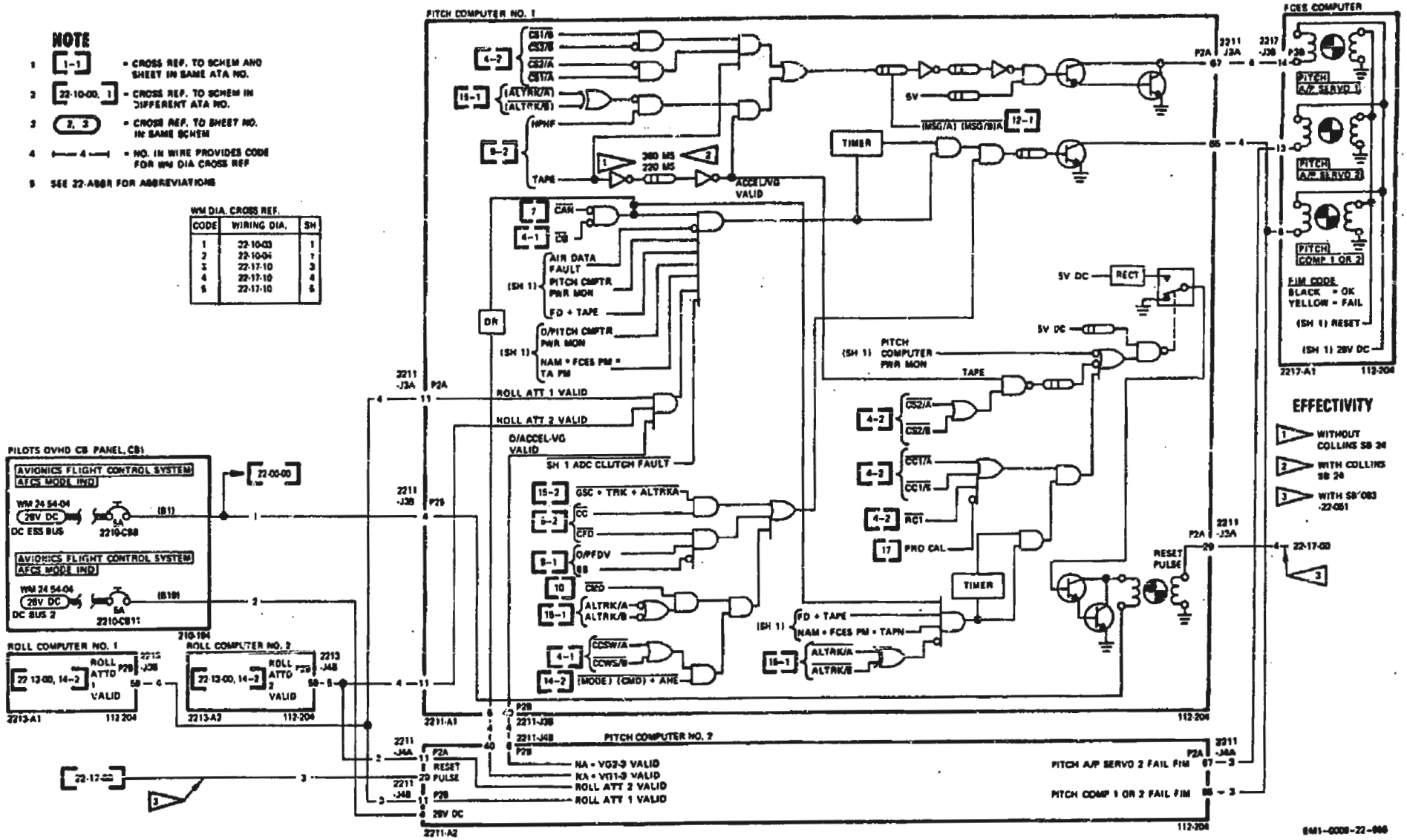
EM1-0006-22-854

R
R

Pitch FIM Schematic
SCHEM 16 (Sheet 1)

EFFECTIVITY: ALL

001B

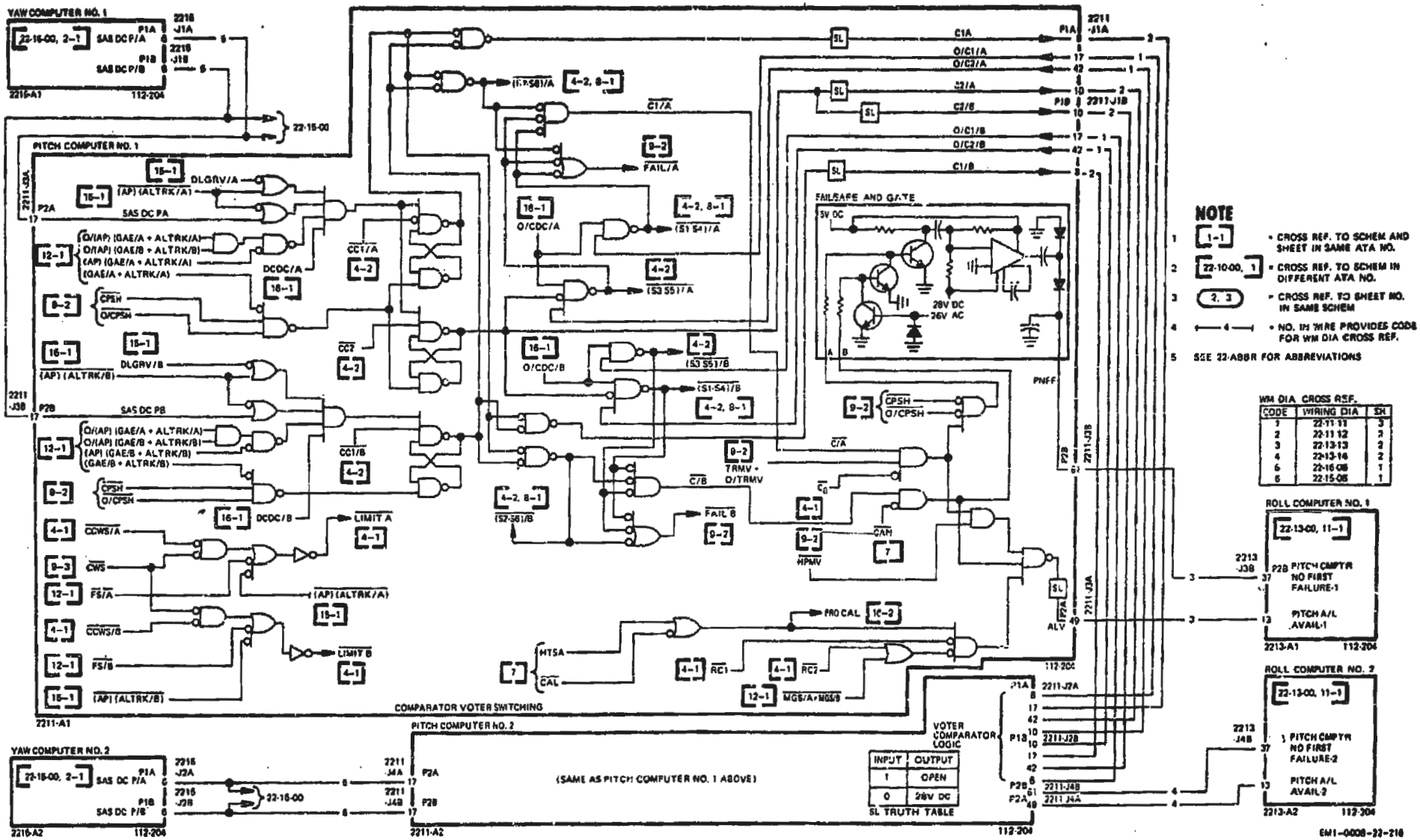

NOTE
1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA. CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-10-03 | 1
2 | 22-10-04 | 1
3 | 22-17-10 | 3
4 | 22-17-10 | 4
5 | 22-17-10 | 5
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
FCES COMPUTER
PITCH A/P SERVO 1
PITCH A/P SERVO 2
PITCH COMP 1 OR 2
FIM CODE
BLACK = OK
YELLOW = FAIL
(SH 1) RESET
(SH 1) 28V DC
TIMER
RECT
5V DC
TAPE
RESET PULSE
ROLL ATT 1 VALID
ROLL ATT 2 VALID
D/ACCEL-VG VALID
SH 1 ADC CLUTCH FAULT
PITCH A/P SERVO 2 FAIL FIM
PITCH COMP 1 OR 2 FAIL FIM
EFFECTIVITY
1 WITHOUT COLLINS SB 24
2 WITH COLLINS SB 24
3 WITH SB 083 -22-051
PILOTS OVHD CB PANEL, CB1
AVIONICS FLIGHT CONTROL SYSTEM AFCS MODE IND
DC ESS BUS
DC BUS 2
ROLL COMPUTER NO. 1
ROLL COMPUTER NO. 2
8481-0008-22-086

Pitch FIM Schematic
SCHEM 16 (Sheet 2)

EFFECTIVITY: ALL

22-11-00
Page 155/156
Mar 15/81

001B


YAW COMPUTER NO. 1
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
YAW COMPUTER NO. 2
COMPARATOR VOTER SWITCHING
FAILSAFE AND GATE
VOTER COMPARATOR LOGIC
SL TRUTH TABLE
INPUT | OUTPUT
1 | OPEN
0 | 28V DC
ROLL COMPUTER NO. 1
ROLL COMPUTER NO. 2
PITCH CMPTR NO FIRST FAILURE-1
PITCH A/L AVAIL-1
PITCH CMPTR NO FIRST FAILURE-2
PITCH A/L AVAIL-2
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-11-11 | 3
2 | 22-11-12 | 3
3 | 22-13-13 | 2
4 | 22-13-14 | 2
6 | 22-16-06 | 1
8 | 22-15-06 | 1
NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 ←4→ • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
(SAME AS PITCH COMPUTER NO. 1 ABOVE)
EM1-0008-22-216

R Pitch Computer No First Fail and Pitch A/L Available Schematic
R SCHEM 17

EFFECTIVITY: ALL

001B

PITCH COMPUTER - REMOVAL AND INSTALLATION

1. Referenced Procedures

29-11-00 Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following applicable circuit breakers:

(a) For pitch computer No. 1:

AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (A6)

Left AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND (B1)

(b) For pitch computer No. 2:

AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (A24)

Right Avionics FLIGHT CONTROL SYSTEM - AFCS MODE IND (B19)

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate computer in center rack (Ref. Fig. 401).

(3) Release holddowns on computer front panel.

(4) Pull computer handle to release computer electrical connectors from mount connectors.

(5) Slide computer out of mount.

B. Installation

R (1) Verify circuit breakers opened in Step A(1) are open and tagged.

(2) Slide computer (Ref. Fig. 401) into mount until computer rear electrical connectors mate with mount connectors.

(3) Secure computer with holddowns.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Perform operational test in Step C.

C. Operational Test

R WARNING: VERIFY FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

R AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

R WARNING: DO NOT ENGAGE AUTOPILOT WHEN AIRCRAFT IS ON JACKS.

(1) Turn on hydraulic systems A and B (Reference 29-11-00).

R (2) On APFDS ENGAGE panel, set applicable AP bat handle to
R CMD.

(3) Move Captains control column forward, aft then center.

RESULT:

Control surfaces follows as indicated on SPI. AP LIMIT warning may come on at extreme travel of control column.

(4) Repeat Step (3) for First Officers control wheel.

R (5) On HEADING/PITCH MODE panel, press VS switchlight to turn on VS light.

RESULT:

R On both AFCS MODES annunciators, VS messages
R displayed.

R (6) Set applicable FD bat handle to ON.

RESULT:

R On applicable ADI, FD flag is out-of-view, and command bar is centered and level.

R (7) On HEADING/PITCH MODE panel, rotate VERT SPEED wheel in
R DN (brown) direction.

RESULT:

Control column should move forward.

Applicable ADI command bar should indicate fly down.

(8) Rotate VERT SPEED wheel in UP (blue) direction.

RESULT:

R Applicable command bar should indicate fly up.

(9) Rotate VERT SPEED wheel to center position.

R (10) On HEADING/PITCH MODE panel, press ALT switchlight to turn on ALT light.

RESULT:

VS light goes out

R On both AFCS MODES annunciators, ALT messages
R displayed and VS messages removed.

R On applicable ADI, FD flag is out-of-view, and command bar is centered and level.

R (11) On HEADING/PITCH MODE panel, press IAS switchlight to turn on IAS light.

RESULT:

ALT light goes out.

R On both AFCS MODES annunciators, IAS messages
R displayed and ALT messages removed.

On applicable ADI, FD flag is out of view, and command bar is centered and level.

R (12) On HEADING/PITCH MODE panel, press MACH switchlight to on.

RESULT:

IAS light goes out.

R On both AFCS MODES annunciators, MACH messages displayed, and IAS messages removed.

On applicable ADI, FD flag is out of view, and command bar is centered and level.

R (13) Press MACH switchlight to off.

(14) On glareshield, set both VHF NAV frequency selectors to 108.1 MHz.

R (15) On NAV MODE panel, press APR switchlight to turn on APR light.

RESULT:

R On both AFCS MODES annunciators, LOC ARM and GS ARM messages displayed. On both AFCS WARNING
R indicators, NO FLARE messages displayed.

On applicable ADI, command bar is centered and level.

R (16) On NAV MODE panel, press A/L switchlight to turn on A/L light.

APR light goes out.

R RESULT: On both AFCS MODES annunciators, LOC ARM, GS ARM and A/L ARM messages displayed.

On applicable ADI, command bar is centered and level.

R (17) Press A/L switchlight to turn off A/L light

RESULT:

R On both AFCS MODES annunciators, messages removed.

R (18) On APFDS ENGAGE panel, press TURB switchlight to turn on TURB light.

RESULT:

R Applicable AP bat handle drops to CWS.

R On both AFCS MODES annunciators, TURB messages
R displayed.

R R On applicable ADI, command bars are biased out-of-view.

R (19) On either control wheel press A/P disengage switch.

RESULT:

R Applicable AP bat handle drops to OFF.

On both AFCS WARNING annunciators, AP DISC and flashing ALERT displays come on.

On applicable ADI, command bar comes in view.

R (20) Press A/P disengage switch.

RESULT:

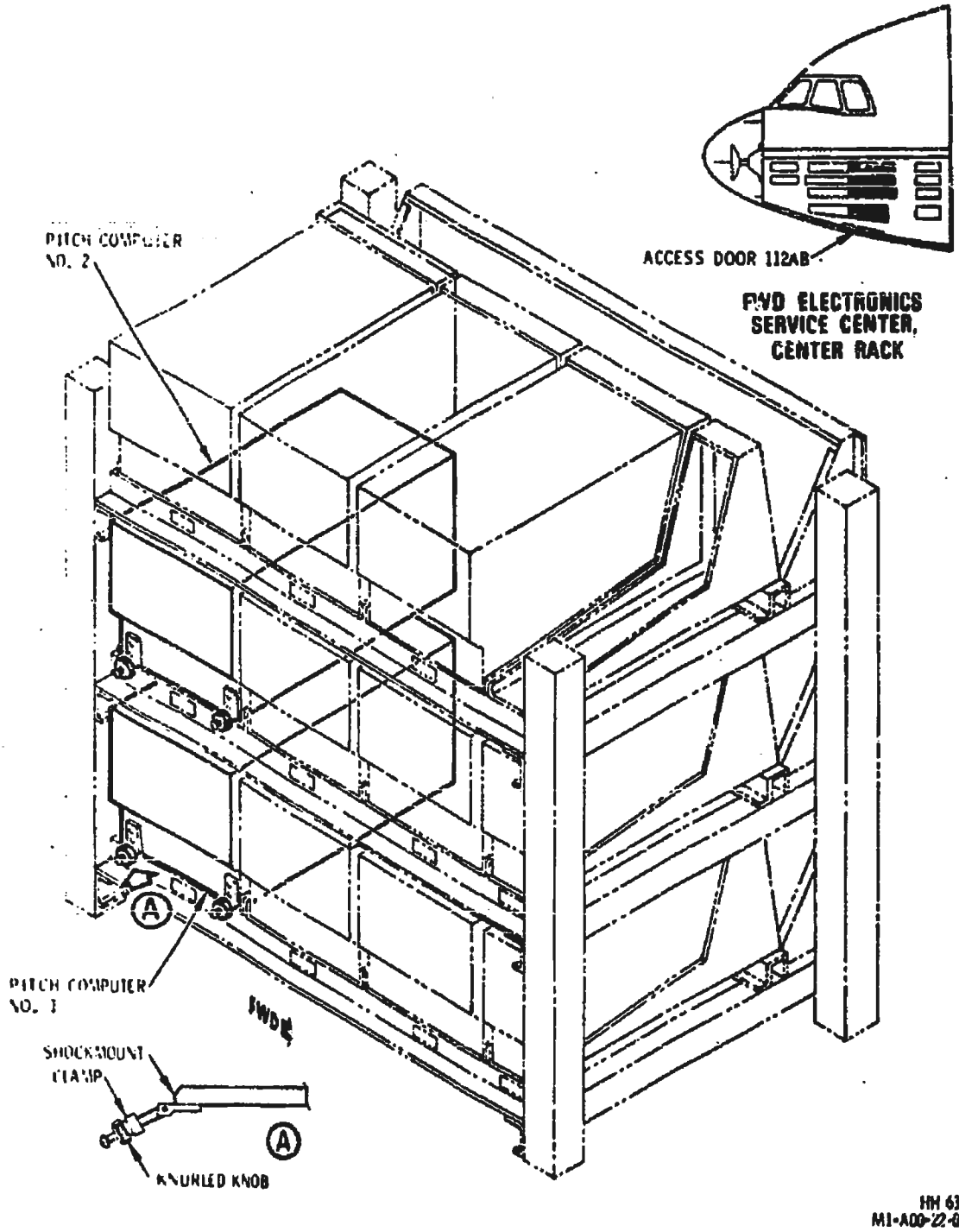
AP DISC and flashing ALERT displays go out.

(21) Set applicable FD switch to OFF.

RESULT:

R R On applicable ADI, command bar is biased out-of-view.

(22) Turn off hydraulic systems.



Pitch Computer - Removal and Installation
Figure 401

NORMAL ACCELEROMETER UNIT - REMOVAL AND INSTALLATION

1. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
34-21-00	Attitude Reference System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

NO. 1 SYSTEMS

PITCH & ROLL (A6)

TRIM AGMT AC (A7)

NO. 2 SYSTEMS

PITCH & ROLL (A24)

TRIM AGMT AC (A25)

FCES COMPUTER AC & L AOA (B5)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag FLIGHT STATION MISC R AOA (F1) circuit breaker.

(2) Open GYROSCOPE ACCESS PANEL in galley ceiling, zone 135.

(3) Disconnect electrical connectors from accelerometer (Ref. Fig. 401).

R (4) Remove mounting screws and remove accelerometer.

B. Installation

The normal accelerometer installation procedure includes operational test of the accelerometer. The test requires

that all other auto flight system components and associated equipment are installed and operational.

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Connect electrical connectors to accelerometer.

(3) Turn on electrical power (Ref. 24-00-00).

(4) Verify that avionics cooling is on (Ref. 21-25-00).

(5) Verify that attitude reference system is on (Ref. 34-21-00).

(6) Remove tags and close circuit breakers opened in Step 2A(1).

On pilots overhead circuit breaker panel CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(7) On FCES control panel, verify that ATS 1 and 2 switchlights are on (latched in) with no FAIL legend annunciated.

(8) Orient accelerometer in direction of mounting.

R (9) Place the speed system in the stall margin mode by performing the following:

R (a) Set flaps to greater than 30 degrees.

R (b) Depress STALL WARN TEST switch on FCES panel to
R rotate AOA sensors and hold STALL WARN TEST switch
R on (depressed) through Step (10).

R (c) Verify that STALL WARN switchlights are latched in
R with no FAIL legend annunciator on.

(10) Simulate airborne condition by removing the AFCS/MLG ACCESSORY UNIT or by opening circuit breakers L8 or F16 on panel CB2.

(11) Tilt accelerometer approximately 60 degrees in either direction. While accelerometer is being tilted, verify that fast/slow indicator on both ADI indicates slow.

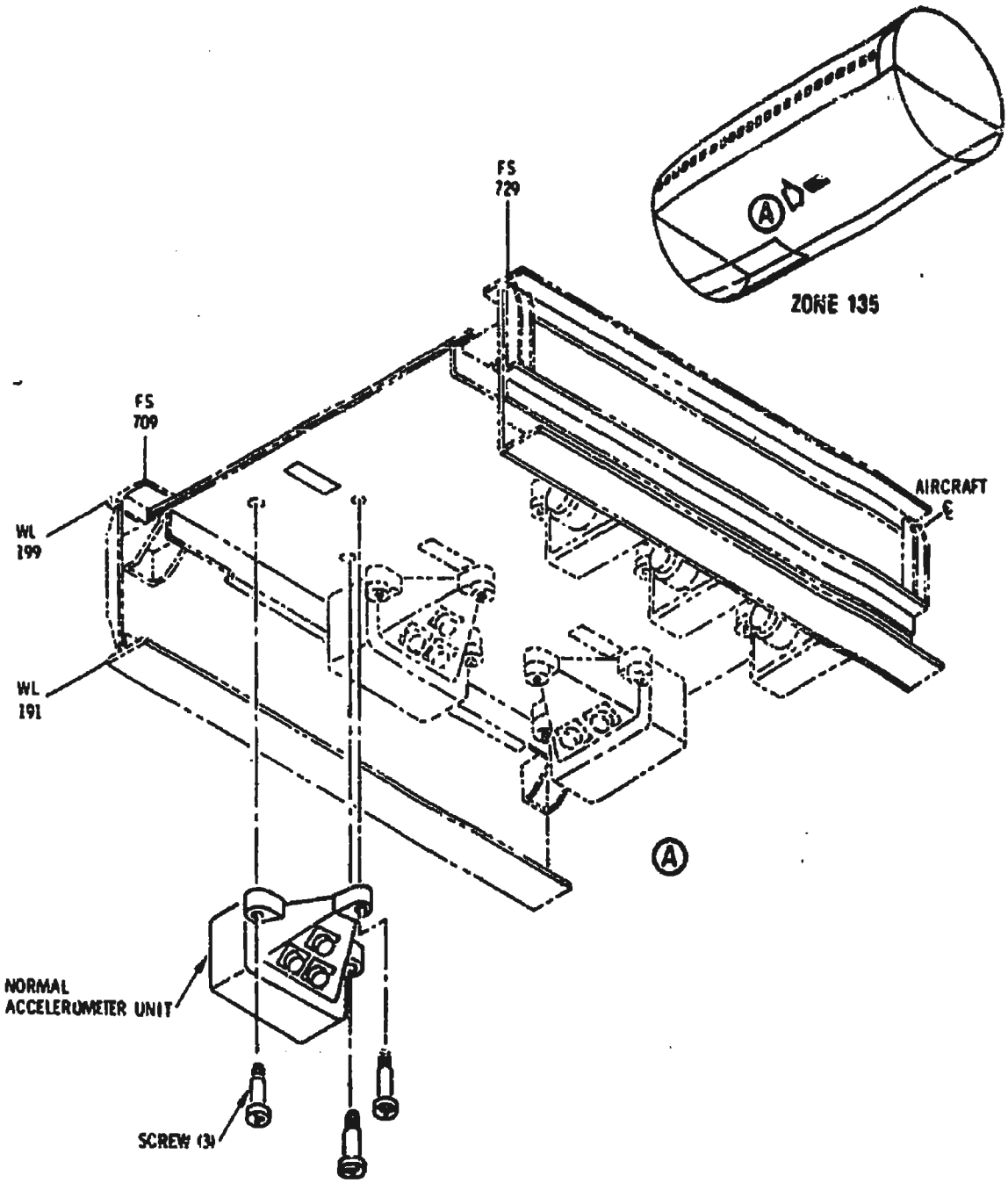
(12) Position accelerometer on mount and secure with mounting screws (Ref. Fig. 401).

(13) Close GYROSCOPE ACCESS PANEL.

(14) On CB1, close D4 and D22 circuit breakers.

(15) Revert to on ground condition by reversing ACTION taken in Step (10)

(16) Turn off electrical power (Ref. 24-00-00).



M1-0001-22-052

R Normal Accelerometer Unit - Removal and Installation
R Figure 401

ALTITUDE SELECT PANEL - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-11-03 Altitude Select Panel - Adjustment and Test

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

R AFCS MODE IND (B1 and B19)

R FCES - COMPUTERS - DC (B4)

(2) Loosen captive screws on ALT SELECT panel located on glareshield panel, zone 210.

(3) Pull out ALT SELECT panel sufficiently from glareshield panel to disconnect electrical connector, and remove panel.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Connect electrical connector to ALT SELECT panel.

(3) Insert ALT SELECT panel into glareshield panel and secure.

(4) Remove tags and close circuit breakers opened in Step A(1).

R (5) Perform altitude select panel adjustment and test (Ref.
R 22-11-03).

ALTITUDE SELECT PANEL - ADJUSTMENT AND TEST

1. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
32-63-00	Air/Ground Sensing System - Maintenance Practices
34-14-00	Central Air Data Computer System - Maintenance Practices

2. Adjustment/Test

R The altitude select (ALT SELECT) panel operational test provided below requires that all other auto flight system components and associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-00-00).

(3) Verify that the central air data computer system is on (Ref. 34-14-00).

(4) On pilots overhead circuit breaker panel CB1, zone 213, verify that the following circuit breakers are closed:

NO. 1 SYSTEMS:

YAW SAS (A5)

PITCH & ROLL (A6)

NO. 2 SYSTEMS:

YAW SAS (A23)

PITCH & ROLL (A24)

AFCS MODE IND (B1)

FCES - COMPUTERS:

DC (B4)

AC & L AOA (B5)

AFCS MODE IND (B19)

INSTR CMPRN MON PWR (D8)

INSTR XFMR NO. 2 (D9)

RADIO ALTM (D22)

INSTR CMPRN MON (D26)

INSTR XFMR NO. 3 (D27)

ALT SOURCE SEL:

CAPTS INSTR (E1)

F/O INSTR (E2)

INS-3/GYRO-3 (E24)

CAPT - ADI (F2)

CAPT - ALTM (F4)

INSTR XFMR NO. 1 (F5)

F/O - ADI (F20)

F/O - ALTM (F22)

DIR GYRO (G5)

VG/INS-1 (G6)

CMPS COUPLER (G7)

DIR GYRO (G23)

INS/VERT GYRO (G24)

CMPS CPLR (G26)

ALT ALERT - 2 (J21)

ALT ALERT - 1 (K27)

ANN RESET (L9)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 214, verify that the following circuit breakers are closed:

R-AOA (F1)

AFCS WARNING:

CAPT (K18)

F/O (K19)

B. Operational Test

(1) Set Captains and First Officers barometric altimeterto local barometric pressure using BARO SET knob.

(2) On ALT SELECT panel, set NORM-STBY switch to NORM, and set ALTITUDE SELECT control knob for an altitude 2000 feet above Captains barometric altimeter indication.

(3) On APFDS ENGAGE panel, set FD A and FD B switches to ON. Both ADI command bars come into view and indicate level flight.

(4) On ALT SELECT panel, depress ARM switchlight to turn on ARM light. On both AFCS MODES annunciators, ALT ARM indication is displayed.

(5) On ALT SELECT panel, depress and hold TEST switch through Step 10.

(6) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until both APPROACH alert indicators come on. APPROACH alert indicators should come on at
R 1000 (±100) feet above Captains barometric altimeter indication.

(7) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until both APPROACH alert indicators go out, both ALTITUDE alert indicators come on, and a 0.5-second audio tone is heard. Above light
R indications occur at 250 (±100) feet above Captains barometric altimeter indication. The 0.5 second tone
R is heard at 500 (±100) feet above Captains barometric altimeter indication when approaching altitude.

(8) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until ALT ARM messages are removed and ALT messages are displayed on AFCS MODES annunciators. ALT hold light on HEADING/PITCH MODE panel comes on, and ARM light on ALT SELECT panel goes

out. Pitch command bars on ADI's should indicate level flight. Above actions occur at Captains barometric altimeter indication plus or minus 100 feet.

(9) Using ALTITUDE SELECT control knob, slowly increase selected altitude until both ALTITUDE alert indicators go out, both DEVIATION alert indicators flash, and a 0.5-second audio tone is heard. The tone should be
R heard at 250 (±100) feet above Captains barometric altimeter indication. The ALTITUDE alert indicators should go out and the DEVIATION alert indicators should
R flash at 500 (±100) feet above Captains barometric altimeter indication.

(10) Release TEST switch.

(11) On HEADING/PITCH MODE panel, depress ALT switchlight to off.

(12) Rotate ALTITUDE SELECT control knob. ALTITUDE alert indicators go off when knob is rotated.

(13) On ALT SELECT panel, set NORM-STBY switch to STBY, and set ALTITUDE SELECT control knob for an altitude 2000 feet above First Officers barometric altimeter indication.

(14) On ALT SELECT panel, depress ARM switchlight to turn on ARM light. On both AFCS MODES annunciator, ALT ARM indication is displayed.

(15) On ALT SELECT panel, depress and hold TEST switch through Step 19.

(16) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until both APPROACH alert indicators come on. APPROACH alert indicators should come on at
R 1000 (±100) feet above First Officers barometric altimeter indication.

(17) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until both APPROACH alert indicators go out, both ALTITUDE alert indicators come on, and a 0.5-second audio tone is heard. Above light
R indications occur at 250 (±100) feet above First Officers barometric altimeter indication. The
R 0.5-second tone is heard at 500 (±100) feet above First Officers barometric altimeter indication when approaching altitude.

(18) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until ALT ARM messages are removed

and ALT messages are displayed on AFCS MODES annunciators. ALT hold light on HEADING/PITCH MODE panel comes on, and ARM light on ALT SELECT panel goes out. Pitch command bars on ADI's should indicate level flight. Above indications occur at First Officers barometric altimeter indication plus or minus 100 feet.

(19) Using ALTITUDE SELECT control knob, slowly increase selected altitude until both ALTITUDE alert indicators go out, both DEVIATION alert indicators flash, and a 0.5-second audio tone is heard. The tone should be
R heard at 250 (±100) feet above First Officers barometric altimeter indication. The ALTITUDE alert indicator should go out and the DEVIATION alert
R indicators should flash at 500 (±100) feet above First Officers barometric altimeter indication.

(20) Release TEST switch.

(21) On HEADING/PITCH MODE panel, depress ALT switchlight to off.

(22) Using ALTITUDE SELECT control knob, increase altitude until ALTITUDE alert indicator goes out.

(23) On pilots overhead circuit breaker panel CB1, zone 213, open FCES COMPUTER DC circuit breaker (B4). On ALT SELECT panel, fault flag covers ALTITUDE SELECT window.

(24) Close FCES COMPUTERS DC circuit breaker (B4) opened in Step 20. Fault flap in ALTITUDE SELECT window is masked from view.

(25) Set FD A and FD B switches to OFF.

C. Test Completion

(1) Turn off electrical power (Ref. 24-00-00).

STABILIZER AUTOPILOT CONTROL SERVO - REMOVAL AND INSTALLATION

1. Equipment and Materials

Autopilot Servo Fixture, PN BF62-101, or equivalent

Jack, Blackhawk T2, or equivalent (Part of BG 88-101)

Container, 1 gallon

Electrical connector protective caps

Hydraulic fitting caps and plugs

Low-adhesion Sealing Compound, LAC Spec C-40-769, or equivalent

R Rigpins:

5/16-inch diameter, 3-inch long (2 required)

5/16-inch diameter, 5-inch long (1 required)

2. Referenced Procedures

6-40-00	Exterior Access Doors and Panels
20-29-01	Hydraulic Fittings - Torque Values
22-01-00	Autopilot Flight Director System - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices
27-41-00	Horizontal Stabilizer Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices
PB75-425	Environmental Sealing of Model L-1011 Aircraft

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS

PITCH & ROLL (A6)

TRIM AGMT - AC (A7)

TRIM AGMT - DC (A8)

NO. 2 SYSTEMS

PITCH & ROLL (A24)

TRIM AGMT - AC (A25)

TRIM AGMT - DC (A26)

(2) Remove access panels 316CB and 316DB and, open access door 317BB (Ref. 6-40-00).

(3) Disconnect electrical connectors from stabilizer autopilot control servo (Ref. Fig. 401). Install protective caps on connectors and plugs.

CR CR (4) Disconnect series trim input push rods from autopilot servo trim input arm. See Fig. 401. Do not lose spacer if installed.

CR CR CR (5) Disconnect summing beam rod linkage from autopilot servo output arm. See Fig. 401. Do not lose spacer if installed.

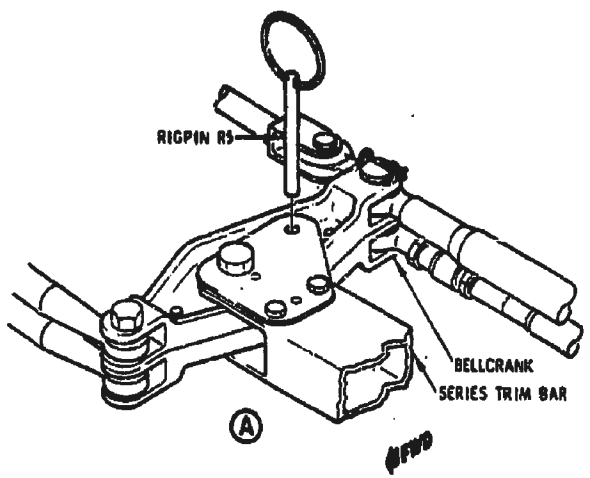
(6) Disconnect hydraulic lines from autopilot servo. Install pressure plugs on hydraulic lines and caps on autopilot servo fittings.

(7) Position autopilot servo fixture and secure to autopilot servo. Position jack to operate fixture.

NOTE: Autopilot servo weighs approximately 92 pounds.

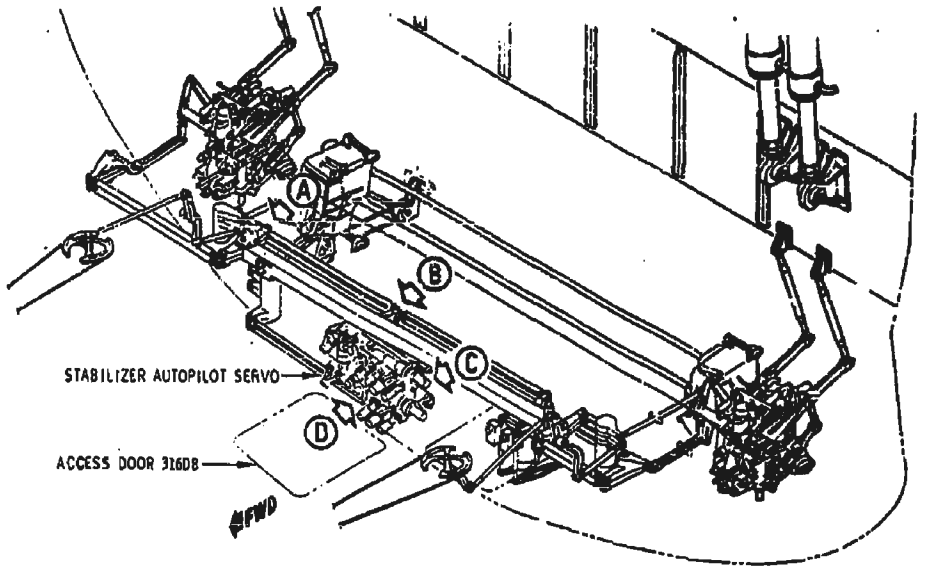
(8) Remove mounting bolts securing autopilot servo to structural bulkhead, starting with lower bolts.

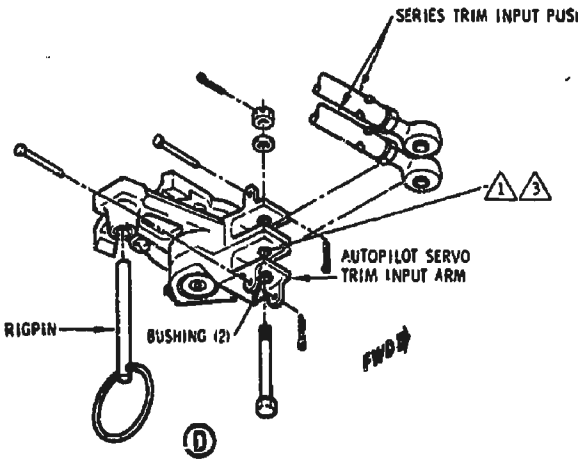
(9) Operate fixture to lower autopilot servo out of aircraft.

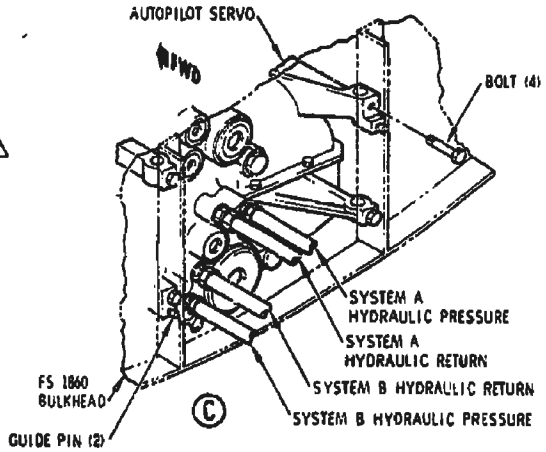


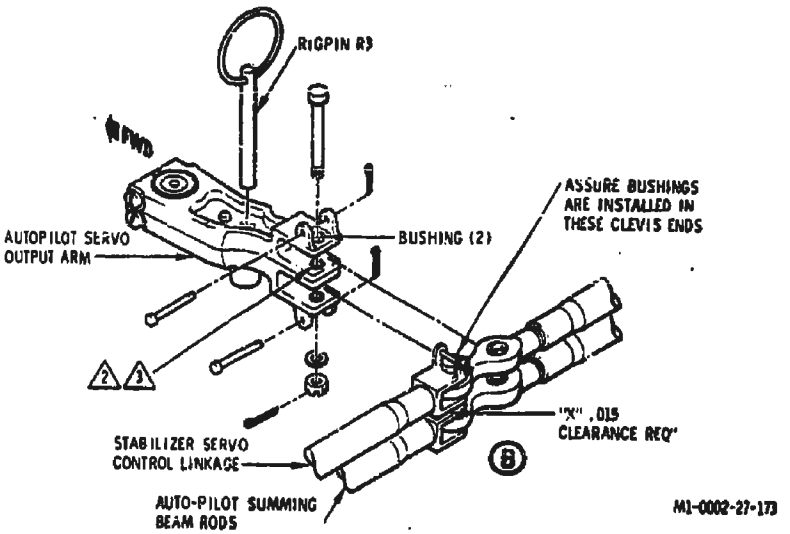
NOTE

1. THIS BUSHING MAY BE SHORT REQUIRING INSTALLATION OF SPACER TO PREVENT ROD END BIND.
2. THIS BUSHING MAY BE SHORT REQUIRING INSTALLATION OF SPACER TO PROVIDE 0.015 CLEARANCE BETWEEN FLUSH BOLTHEADS AT POINT "X".
3. BUSHING SHOULDER IS CAPTURED BETWEEN ARM HALVES. CANNOT BE READILY REPLACED. DO NOT ATTEMPT TO REMOVE.









R Stabilizer Autopilot Control Servo - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

NOTE: Autopilot servo weighs approximately 92 pounds.

(2) Secure autopilot servo on fixture.

(3) Clean mounting surfaces to provide electrical bond.

(4) Operate fixture to raise autopilot servo into mounting position against bulkhead with guide pins on servo mounting legs inserted through bulkhead (Ref. Fig. 401).

(5) Wet-install mounting bolts with sealing compound in accordance with PB75-425.

(6) Remove fixture from autopilot servo.

(7) Remove caps from autopilot servo hydraulic fittings and pressure plugs from hydraulic lines. Connect hydraulic lines to autopilot servo. Torque fittings (Ref. 20-29-01).

C (8) Connect summing beam rod linkage to autopilot servo
C output arm as follows:

C (a) Assure bushings are installed in summing beam rod
C clevises. See Fig. 401.

C (b) Verify that bushings are installed in
C lever-attaching point. Insert spacer (If req'd)
CR between rod end bearing and center bushing to
CR provide .015 clearance between flush head bolts.

Install cotter pin.

(c) Connect to arm with bolt, washer, and nut. Install cotter pin.

(d) Install flathead pin and cotter pin on each side of arm-attaching point.

(9) Connect series trim input push rods to autopilot servo trim input arm as follows:

C (a) Verify that bushings are installed in arm-attaching point. Insert spacer (If req'd) between rod and bearing and center bushing. Ref. Fig. 401.

(b) Connect push rods to arm with bolt, washer, and nut. Install cotter pin.

(c) Install flathead pin and cotter pin on each side of arm-attaching point.

(10) Remove protective caps from electrical connectors and plugs. Connect electrical connectors to autopilot servo.

(11) Perform rigging check as follows:

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Remove tags from Flight Engineer/Second Officers hydraulic system panel and from hydraulic service panel.

(b) Turn on all four hydraulic systems (Ref. 29-11-00).

(c) Set mechanical trim wheel, zone 210, to 4-degree trim position.

R (d) Install rigpin (5/16-inch diameter, 5-inch long) through series trim bar and bellcrank (Ref. Fig. 401).

R (e) Install rigpin (5/16-inch diameter, 3-inch long) through autopilot servo output arm and into servo.

R (f) Verify that rigpin (5/16-inch diameter, 3-inch long) fits freely through autopilot servo trim input arm and into servo. If not, perform rigging check and adjustment of stabilizer servo control linkages (Ref. 27-41-00).

R (g) Remove rigpins installed in Steps 3B(11)(d) through 3B(11)(f).

(12) Remove tags and close circuit breakers opened in Step 3A(1).

(13) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breakers STABILIZER SERVO - A, B, C, and D are closed.

(14) Turn on electrical power (Ref. 24-41-00).

(15) Prepare autopilot flight director system for autopilot engagement (Ref. 22-01-00).

R WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(16) On APFDS ENGAGE panel, zone 210, set autopilot engage switch A to CWS. Verify that switch A remains in CWS.

(17) Bleed autopilot servo by slowly operating either control column forward and aft through approximately 10 full cycles.

(18) Slowly operate control column. Verify stabilizer movement on surface position indicator.

(19) Set autopilot engage switch A to OFF and switch B to CWS.

(20) Repeat Steps 3B(17) and 3B(18).

R (21) Set autopilot engage switch B to OFF.

R (22) Turn off hydraulic power (Ref. 29-11-00).

(23) Turn off electrical power (Ref. 24-41-00).

(24) Check for leaks at autopilot servo hydraulic fittings.

(25) Close access door 317BB, and install access panels 316CB and 316DB.

FILTER ELEMENT, STABILIZER AUTOPILOT CONTROL SERVO - REMOVAL AND INSTALLATION

1. Equipment and Materials

Drip pan, 1-gallon capacity

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

Hydraulic Fluid, LAC Spec C-34-1224, or equivalent

2. Referenced Procedure

24-41-00	External Power/Ground Service System - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). PLACARD FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

A. Removal

(1) Open horizontal stabilizer autopilot servo control access door 316DB, for access to stabilizer autopilot servo control.

(2) Place drip pan under stabilizer autopilot servo control to catch hydraulic fluid.

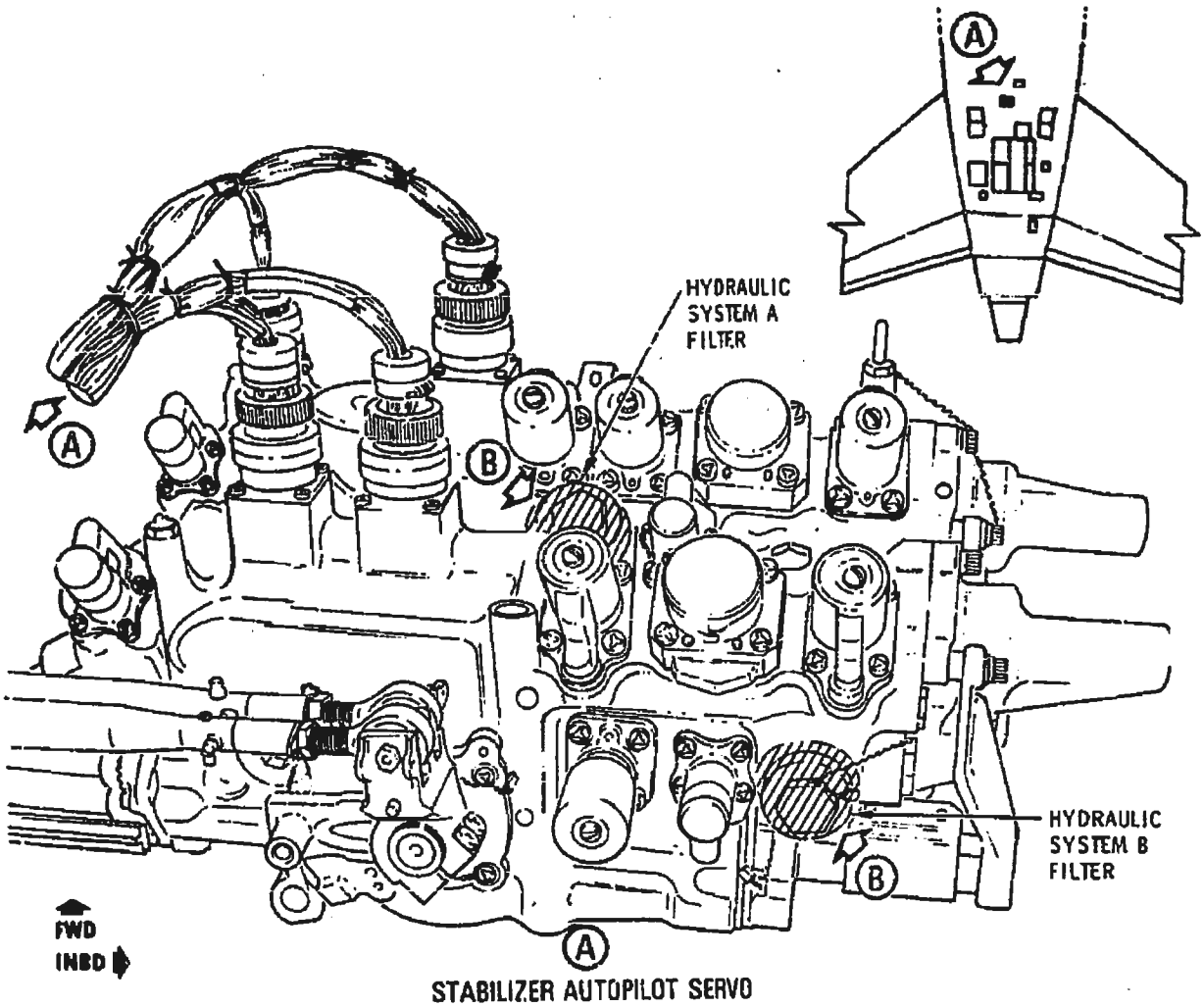
(3) Remove filter cap from servo control (Ref. Fig. 401).

(4) Remove and discard backup ring, preformed packing, and backup ring from filter cap.

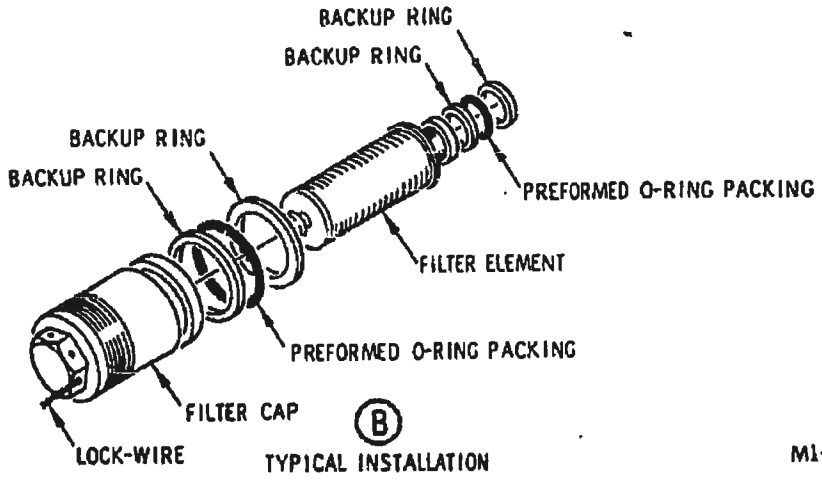
(5) Pull filter element from servo control. Remove and discard backup ring, preformed packing, and backup ring from filter element.

B. Installation

(1) Wet preformed packings and backup rings with hydraulic fluid before installation.



STABILIZER AUTOPILOT SERVO
VIEW LOOKING UP AT FWD FACE OF FS 1860 BULKHEAD



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Filter Element, Stabilizer Autopilot Servo Control
Removal and Installation
Figure 401

(2) Install backup ring, preformed packing, and backup ring on filter element.

(3) Install filter element in autopilot servo control.

(4) Install backup ring, preformed packing, and backup ring in groove on filter cap.

R CAUTION: DO NOT EXCEED 250 LB IN. WHEN TIGHTENING FILTER CAP.

(5) Install filter cap over filter element and torque 200 to 250 lb in. Attach lock-wire to filter cap and manifold.

(6) Remove placards installed at beginning of Paragraph 3.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(7) Turn on electrical power (Ref. 24-41-00).

(8) Turn on hydraulic system A and B (Ref. 29-11-00).

(9) Bleed autopilot servo as follows:

(a) On APFDS ENGAGE panel, set AP A or B switch to CWS (Ref. 22-00-00, Adjustment and Test).

(b) Cycle control column forward and aft a minimum of five times, or until control feels smooth.

(10) Visually determine that filter cap is not leaking.

(11) Position AP A or B switch to OFF.

(12) Turn off hydraulic power (Ref. 29-11-00).

(13) Turn off electrical power (Ref. 24-41-00).

(14) Close and secure access door opened in Step 3A(1).

AUTOPILOT SERVO SOLENOID SHUTOFF VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Container, 1 quart

Control Column and Trim Wheel Lock, PN BA80-101, or equivalent

Gasket (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

2. Referenced Procedure

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Open and tag applicable circuit breaker:

On pilots overhead circuit breaker panel CB1, zone 210, AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (A6), or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (A24)

(2) Install control column and trim wheel lock.

(3) Oper lower afterbody access panel 316DB - autopilot servo.

(4) Place container under servo.

(5) Remove mount bolts and remove valve (Ref. Fig. 401).

(6) Remove and discard plate gasket.

(7) Remove and discard preformed O-ring packing from valve electrical connection groove.

B. Installation

(1) Verify that circuit breaker(s) opened in Step 3A(1) is open and tagged.

(2) Install new preformed O-ring packing on valve electrical connection groove.

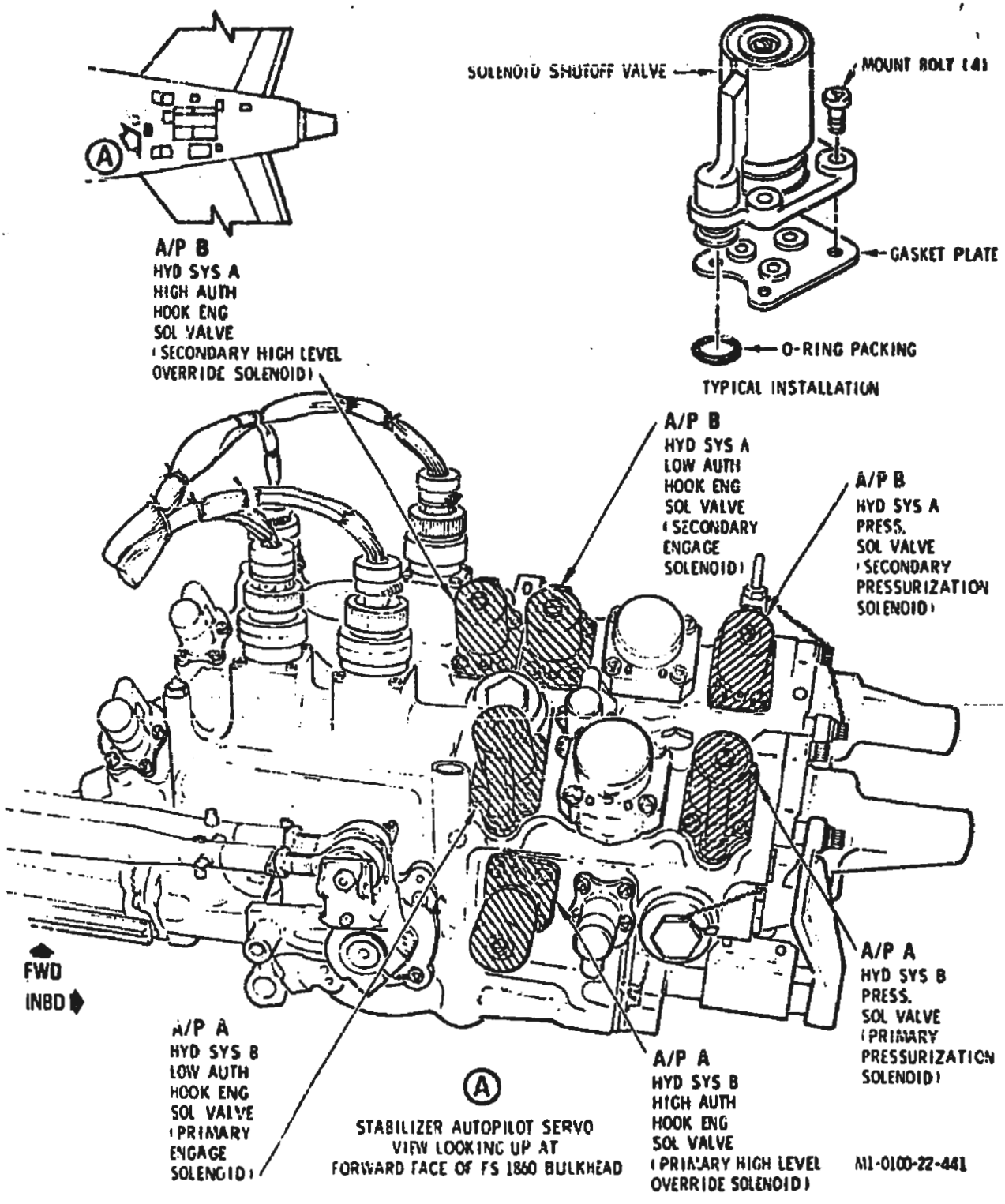
(3) Install new plate gasket and valve. Secure with mount bolts and lock-wire.

(4) Close access panel.

(5) Remove tag and close circuit breaker opened in Step 3A(1).

(6) Remove tags installed at beginning of Paragraph 3.

(7) Remove control column and trim wheel lock.



R Autopilot Servo Solenoid Shutoff Valve Removal/Installation
R Figure 401

EFFECTIVITY: ALL

STABILIZER AUTOPILOT SERVO ELECTROHYDRAULIC SERVO VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

   Container, 1 quart

   Gasket (Ref. Fig. 401)

   Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

   O-ring (Ref. Fig. 401)

2. Referenced Procedure

   29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

   A. Removal

      WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers: AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (A6), or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (A24).

R   (2) Open lower afterbody access panel 3160B.

      (3) Place container under servo valve.

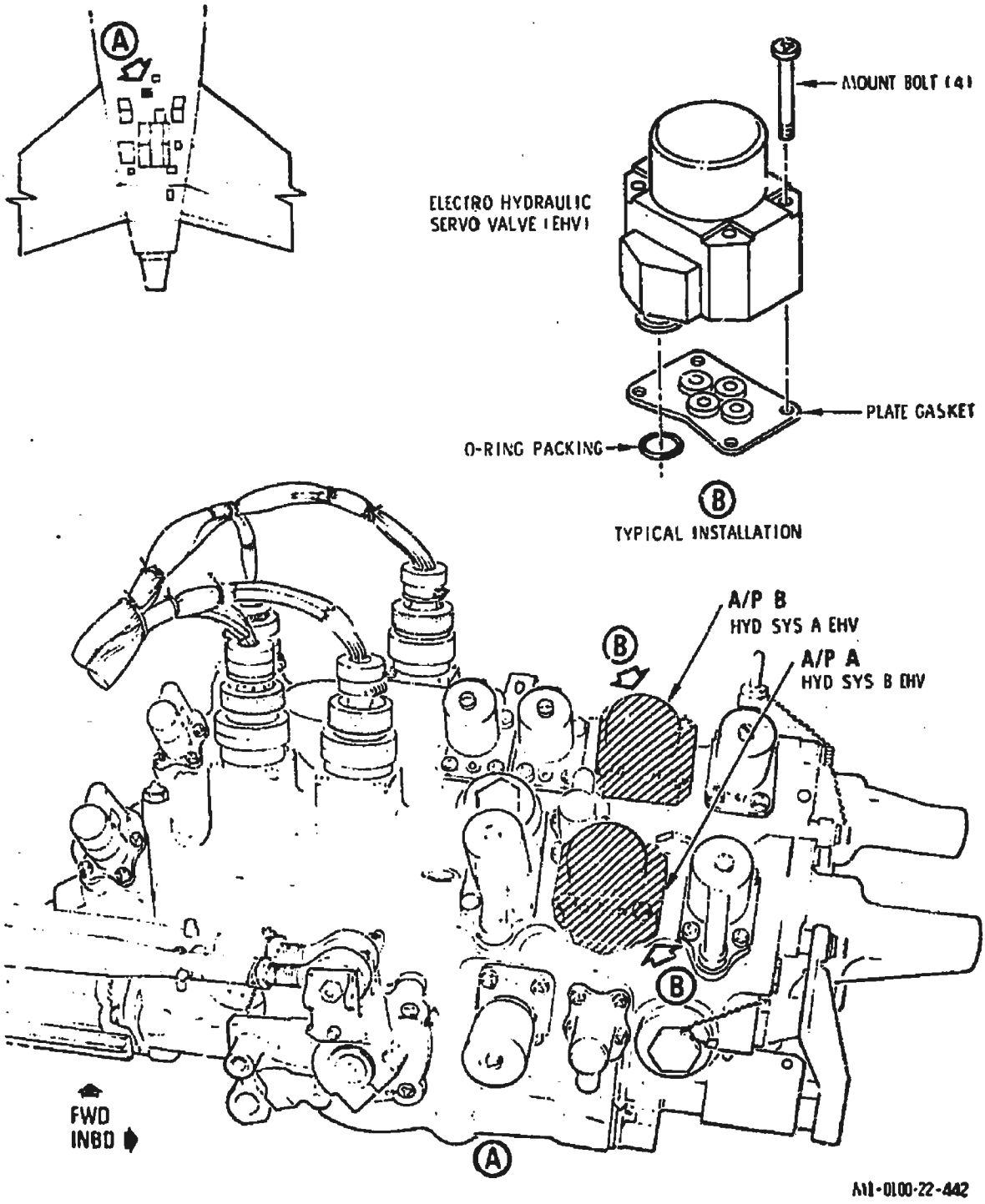
      (4) Remove mount bolts and remove valve (Ref. Fig. 401).

      (5) Remove and discard plate gasket.

      (6) Remove and discard preformed O-ring packing from valve electrical connection groove.

   B. Installation

      (1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.



R Stabilizer Autopilot Servo Electrohydraulic Servo Valve
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

0018

(4) Apply manual roll command on either control wheel. Verify that surface position indicator shows a rudder displacement.

(5) Depress YAW SAS 1 switchlight to on.

(6) On pilots overhead circuit breaker panel CB1, open AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS (A5) - YAW SAS and AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS (A23) circuit breakers. Verify that both YAW SAS switchlights indicate FAIL.

(7) Close circuit breakers opened in Step B(6).

(8) Reset YAW SAS switchlights by depressing OFF and then on.

C. STALL WARNING Switchlight Test

(1) Depress STALL WARN 1 switchlight to on and STALL WARN 2 switchlight to OFF.

(2) Depress and hold stall warning TEST switch. Verify that both control columns vibrate.

(3) Release TEST switch.

(4) On pilots overhead circuit breaker panel CB1, open AVIONICS FLIGHT CONTROL SYSTEM - FCES - COMPUTERS - AC 2 L AOA (B5) circuit breaker. Verify that STALL WARN 1 switchlight indicates FAIL.

(5) Close circuit breaker opened in Step C(4).

(6) Depress STALL WARN 1 switchlight to OFF and STALL WARN 2 switchlight to on.

(7) Depress and hold TEST switch. Verify that both control columns vibrate.

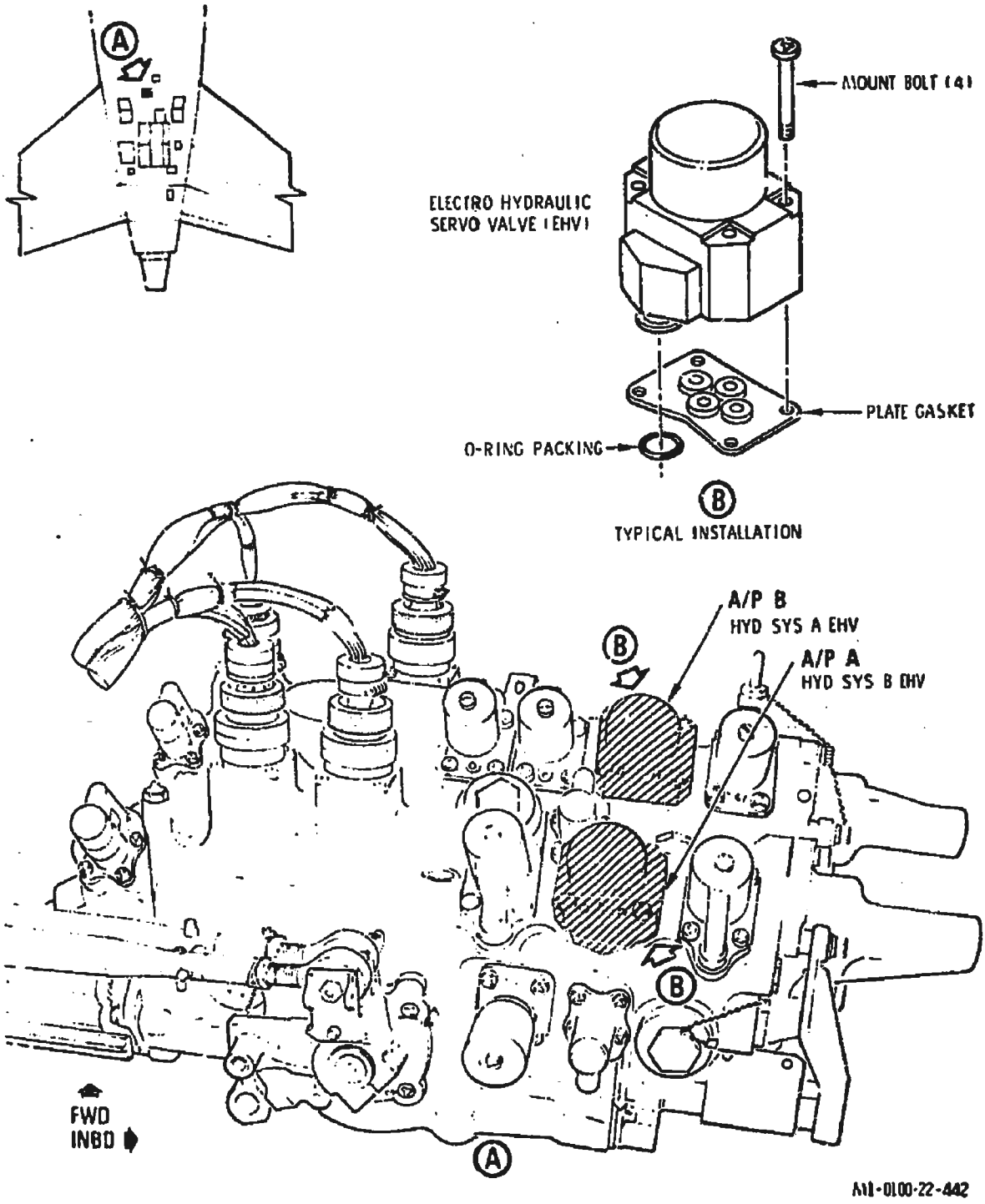
(8) Release TEST switch.

(9) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open FLIGHT STATION MISC - R AOA (F1) circuit breaker. Verify that STALL WARN 2 switchlight indicates FAIL.

(10) Close circuit breaker opened in Step C(9).

(11) Depress STALL WARN 2 switchlight to OFF.

(12) Depress STALL WARN 1 and 2 switchlights to on.



R Stabilizer Autopilot Servo Electrohydraulic Servo Valve
R Removal and Installation
R Figure 401

EFFECTIVITY: ALL

0018

(2) Install new preformed O-ring packing on valve electrical connection groove.

(3) Install new plate gasket and valve. Secure with mount bolts and lock-wire.

(4) Close access panels.

(5) Remove tag and close circuit breaker opened in Step 3A(1).

(6) Remove tags installed at beginning of Paragraph 3.

STABILIZER AUTOPILOT SERVO PRESSURE SWITCH REMOVAL AND INSTALLATION

1. Equipment and Materials

Gasket (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

2. Referenced Procedure

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

R (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers: AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (A6), or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (A24).

(2) Open lower afterbody access panel 316DB.

(3) Remove mount bolts and remove valve (Ref. Fig. 401).

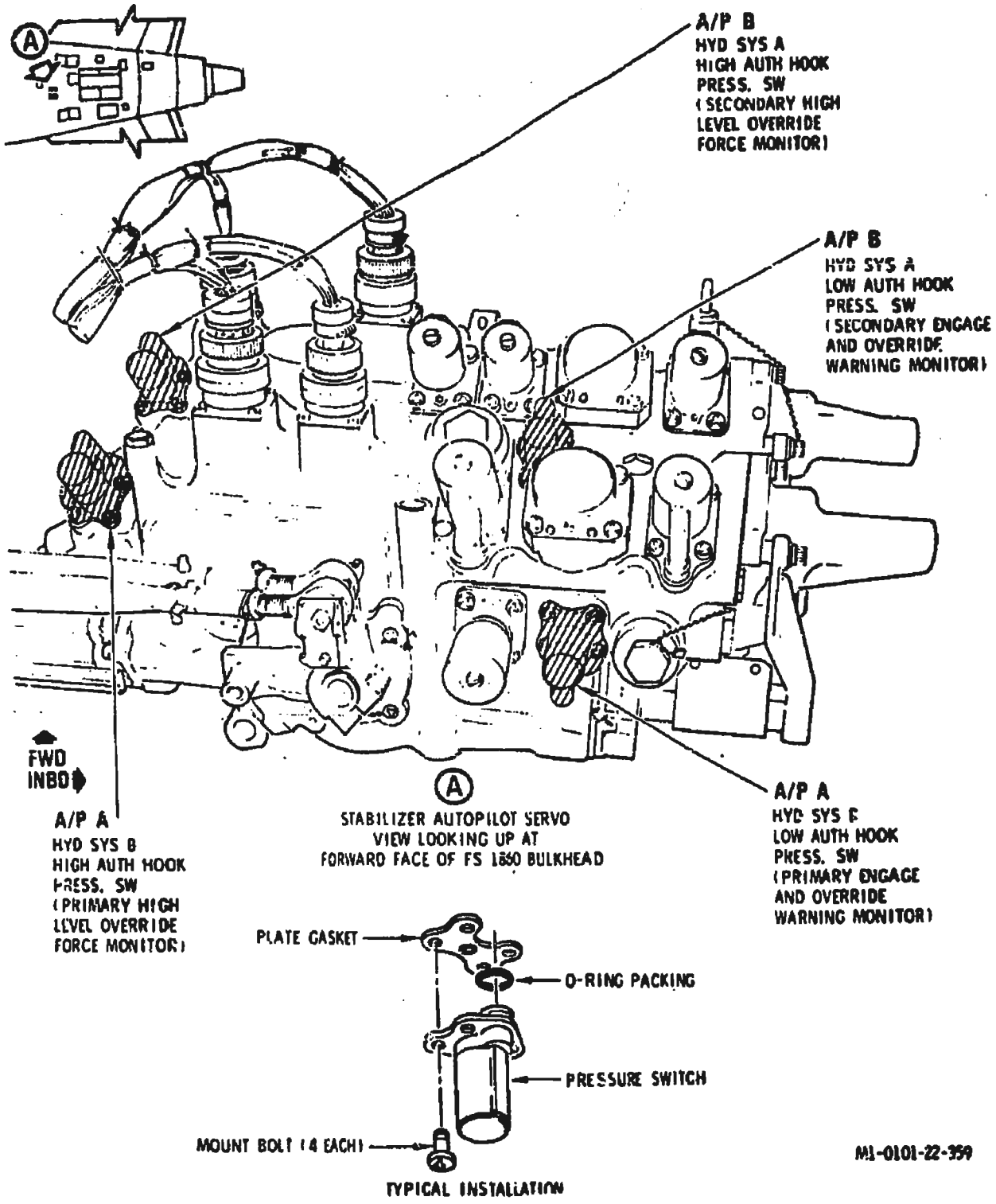
(4) Remove and discard plate gasket.

(5) Remove and discard preformed O-ring packing from switch electrical connection groove.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

(2) Install new preformed O-ring packing on switch electrical connection groove.



R Stabilizer Autopilot Servo Pressure Switch
R Removal and Installation
R Figure 401

(3) Install new plate gasket and switch. Secure with mount bolts and lock-wire.

(4) Close access panel.

(5) Remove tag and close circuit breaker opened in Step 3A(1).

(6) Remove tags installed at beginning of Paragraph 3.

STABILIZER AUTOPILOT SERVO CASE RELIEF VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

Container, 1 quart

Lockwire, Fed Spec QQ-W-390, Cond A, 0.032-inch diameter, or equivalent

O-ring (Ref. Fig. 401)

2. Referenced Procedure

24-00-00 Electrical Power - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

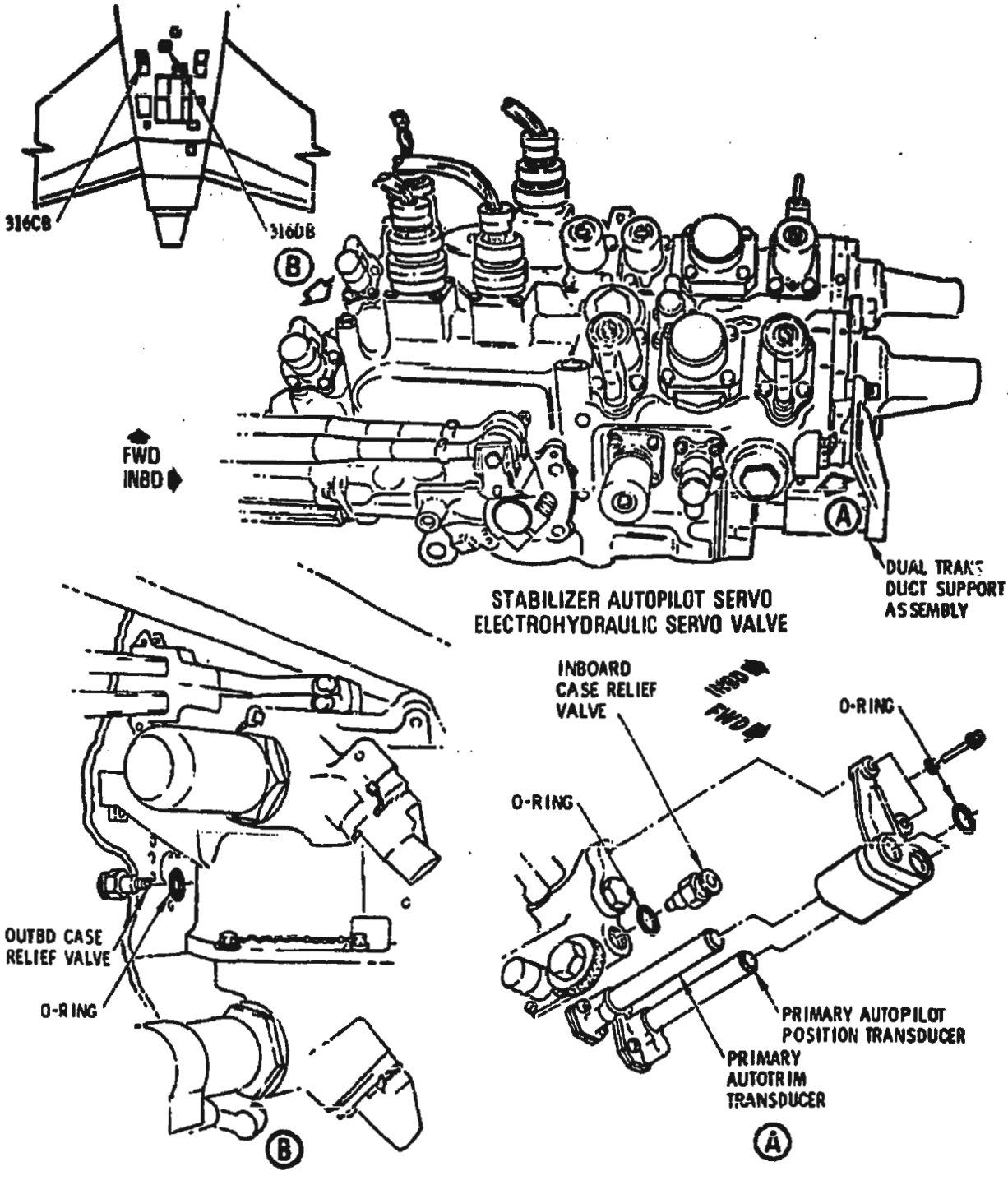
WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following circuit breakers. AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (A6), or AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - PITCH & ROLL (A24). R

(2) Open lower afterbody access panel 316DB for inboard case relief valve and panel 316CB for outboard case relief valve (Ref. Fig. 401).

(3) Place container under case relief valve to be removed.

(4) For the inboard case relief valve, remove the dual transducer support assembly bolts (2) and remove the support assembly (Ref. Fig. 401). This allows access to the case relief valve. The outboard case relief valve is accessible without the removal of any supports.



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R Stabilizer Autopilot Servo Case Relief Valve Assembly
R Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B

(5) Remove case relief valve. Cover cavity for protection from contamination if replacement valve is not to be installed immediately.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Install new case relief valve with new O-rings
R NAS1611-012. Torque to 20-25 lb-in. and lock-wire.

(3) After installing inboard case relief valve:

(a) Install new O-rings on the primary autotrim transducer and primary autopilot position transducer.

(b) Install dual transducer support assembly. Secure
R with mount bolts (2). Torque to 60-75 lb-in. and
R lock-wire.

(4) Remove tags and close circuit breakers opened in Step 3A(1).

(5) Perform leak test.

C. Leak Test

(1) Turn on electrical power (Ref. 24-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWN LOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(2) Turn on hydraulic systems A and B (Ref. 29-11-00).

(3) Bleed autopilot servo as follows:

(a) On APFDS ENGAGE panel, set AP A (for inboard relief valve) or B (for outboard relief valve) switch to CWS.

R R (b) Cycle control column forward and aft a minimum of five times, or until control feels smooth.

R R (4) Visually determine that case relief valve is not leaking.

R (5) Position AP A or B switch to OFF.

R (6) Turn off hydraulic power (Ref. 29-11-00).

R (7) Turn off electrical power (Ref. 24-00-00).

R (8) Close and secure access door opened in Step 3A(2).

FD VERTICAL SPEED MODE - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting FD vertical speed (VS) mode faults are included in this section of the manual. A FD VS mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use FD VS mode fault matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the FD VS mode fault isolation diagrams and schematics. Figures 101 and 102 provide component location for FD VS mode troubleshooting.

A. General

R FD vertical speed (VS) mode fault isolation contains two levels of troubleshooting: (1) fault oriented, and
R (2) system oriented. Fault oriented fault isolation troubleshoots a specific FD VS mode problem. System oriented fault isolation (Ref. 22-11-31, Page 501)
R tests and troubleshoots FD VS mode problems.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the FD VS mode by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-11-31, Page 501) to isolate problem.

Figure 104 provides diagnostic steps to further isolate
R the fault. The diagnostic steps are in flow chart form

R containing complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the actions are outside the blocks. When using the flow charts, it is assumed that systems are in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

R Fault Isolation Diagrams and Schematic List
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	FD VS Mode Fault Matrix
104	FD VS Mode Faults
105	FD VS Mode Simplified Schematic
22-11-00 SCHEM 5	Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic
22-11-00 SCHEM 6	Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic
22-11-00 SCHEM 13	Turbulence, Vertical Speed, Indicated Air Speed, and V NAV Engage Logic Schematic.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCELEROMETER – NORMAL	1	GALY CLG/135DB	22–11–02
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34–14–01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22–11–01
COMPUTER – TRIM AUGMENTATION	1	FESC, CTR RACK/112AB	22–18–01
CONTROL BOX – INDICATOR LIGHTS CARD 1A2	1	FESC/112AB	33–17–04
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22–10–05
PANEL – HEADING/PITCH MODE COMMAND	1	FLT STA, GLRSHLD PNL	22–10–03

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R R Component Location Index
Figure 101

R R EFFECTIVITY: ALL

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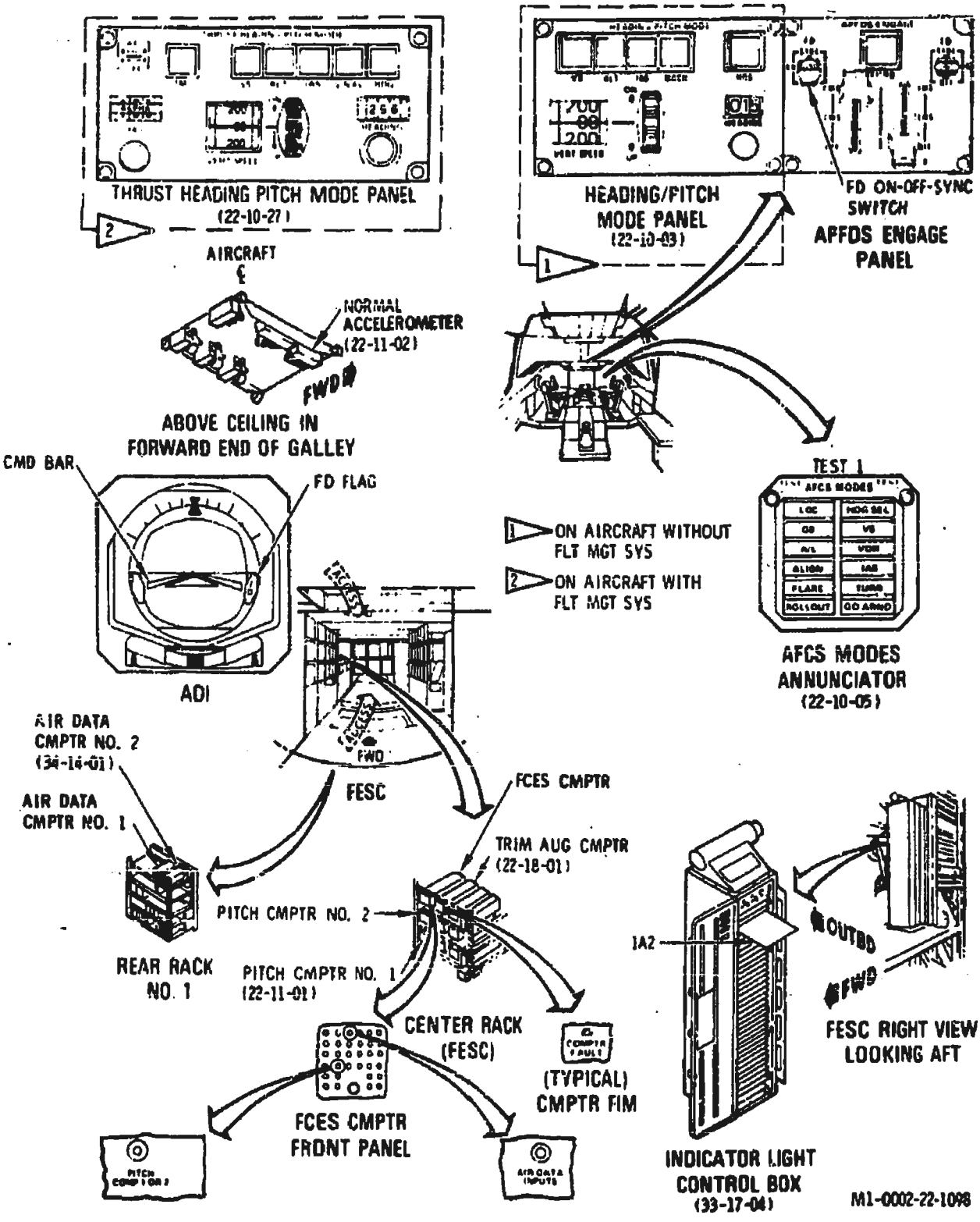


R Component Locator Diagram
R Figure 102

EFFECTIVITY: ALL

No.	FAULTS — Problem (Capt of F/O)	FIM — Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: ADC	PC	NA	TAC	NO FIM — Troubleshooting Faulty LRU: Continuity Check or Replace: AFCS MODES	HDG/PITCH MODE PNL	ILCB CARD
	Capt FIRM Codes With -1 / F/O FIRM Codes With -2 / X Use With Both FIRM Codes							
VERTICAL SPEED TAPE FAULTS – VS MODE NOT ENGAGED								
1	Vertical speed tape does not zero when indicated VS is zero. VS mode is not engaged	1/2	1/2	X			X	
2	Vertical speed tape does not drive to indicated VS. VS mode is not engaged						X	
3	Vertical speed tape drives past indicated VS. VS mode is not engaged		1/2				X	
VS MODE FAULTS – BOTH FD ON								
11	With AP A(B) turned on and VS mode engaged, aircraft climbs or descends at a different rate (as indicated on the vertical speed ind) than the VS selected on HDG/PITCH MODE pnl. When the other AP is engaged, aircraft climb and descent is normal. Capt & F/O ADI CMD bars do not track together in either case	1/2	1/2	X	X			
12	FD flag in-view and CMD bar out-of-view on Capt (F/O) ADI. Both FD are engaged in VS mode. AP (same side) drops from CMD to CWS if turned on	1/2	1/2					
13	VS mode not displayed on Capt (F/O) AFCS mode annunciator. Both FD are engaged in VS mode. ADI CMD bar (same side) follows thumbwheel in pitch		1/2			C/F		
14	VS mode not displayed on Capt (F/O) AFCS modes annunciator. Both FD are engaged in VS mode. ADI CMD bar (same side) does not follow thumbwheel in pitch		1/2				X	
15	VS mode light does not come on when depressed							1A2 CARD
16	Both ADI CMD bars do not follow thumbwheel (wheel spins free). If either AP on, unable to control rate of climb						X	
17	When VS mode is engaged, VERT SPEED tape slips when the desired VS is selected manually by the thumbwheel						X	
18	Capt (F/O) ADI CMD bar does not follow thumbwheel, other ADI bar does follow in pitch. Both FD are engaged engaged in VS mode		1/2				X	

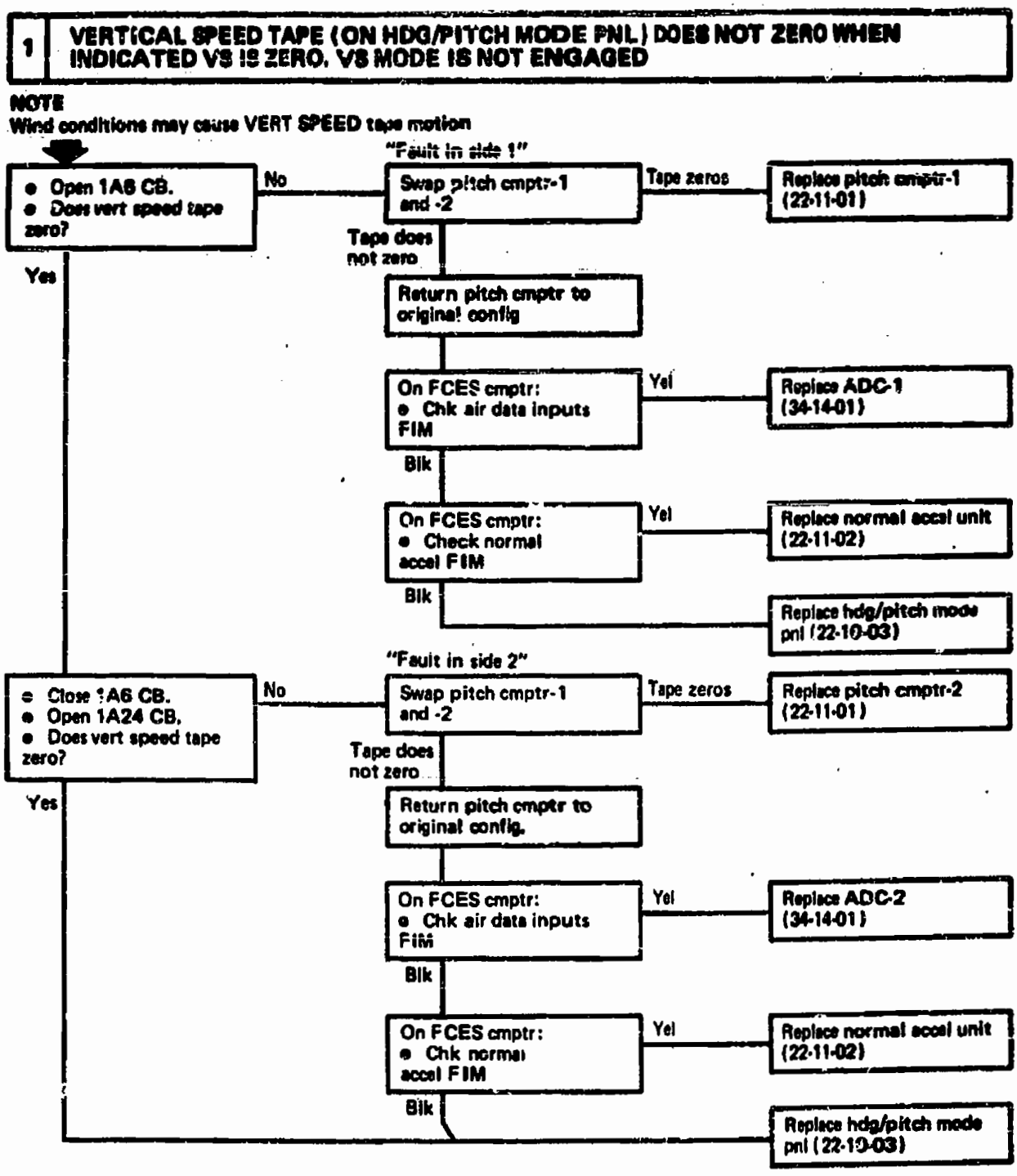
Abbreviations		Removal and Installation Ref. Chapt	Page
ADC	Air Data Computer	34-14-01	401
HDG/PITCH PNL	Heading/Pitch Mode Panel	22-10-03	401
ILCB CARD	Indicator Lights Control Box Card	33-17-00	401
MODES ANN	AFCS Modes Annunciator	22-10-05	401
NA	Normal Accelerometer	22-11-02	401
PC	Pitch Computer	22-11-01	401
TAC	Trim Aug Computer	22-18-01	401

HOW TO USE:

1. Find flight squawk in FAULTS Column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 M1-0104-22-1103

R FD VS Mode Fault Matrix
R Figure 103

R EFFECTIVITY: ALL
R
001B



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R FD VS Mode Faults
R Figure 104 (Sheet 1)

EFFECTIVITY: ALL

001B

2 VERTICAL SPEED TAPE (ON HDG/PITCH MODE PNL) DOES NOT DRIVE TO INDICATED VS. VS MODE IS NOT ENGAGED

→ Replace hdg/pitch mode pnl (22-10-03)

3 VERTICAL SPEED TAPE (ON HDG/PITCH MODE PNL) DRIVES PAST INDICATED VERTICAL SPEED. VS MODE NOT ENGAGED

- Set FD A sw to ON.
- Engage VS mode.
- Vary UP–DN knob on hdg/pitch mode pnl.
- Did pitch CMD bar on Capt ADI follow UP–DN knob?

No → Chk ckt #1

"Open followup ckt -1 side"

- Ckt #1 chk OK → Replace pitch cmptr-1 (22-11-01)
- Hdg/pitch mode pnl has internal open/short ckt → Replace hdg/pitch mode pnl (22-10-03)
- A/C wiring fault → Repair wiring

Yes

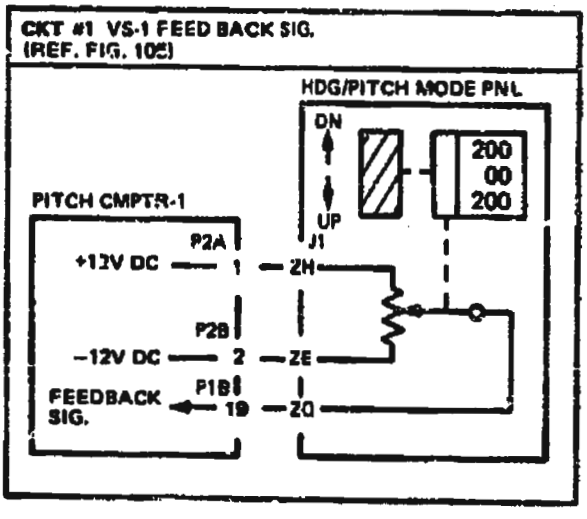
- Set FD A sw to OFF.
- Set FD B sw to ON.
- Engage VS mode.
- Vary UP–DN knob.
- Did pitch CMD bar on F/O ADI follow UP–DN knob?

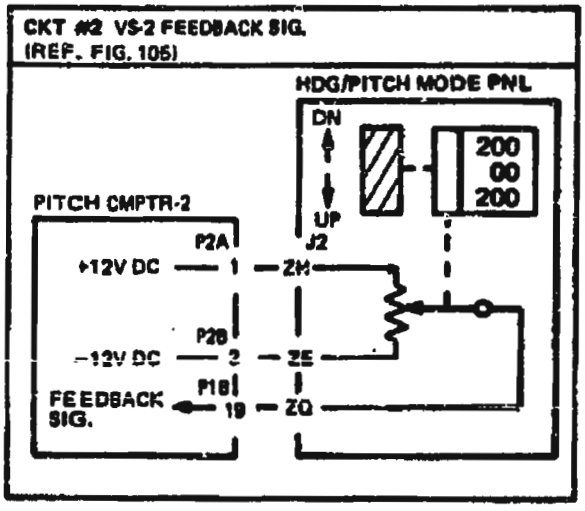
No → Chk ckt #2

"Open followup ckt -2 side"

- Ckt #2 chk ok → Replace pitch cmptr-2 (22-11-01)
- Hdg/pitch mode pnl has internal open/short ckt → Replace hdg/pitch mode pnl (22-10-03)
- A/C wiring fault → Repair wiring

Yes → Go to Fault 1





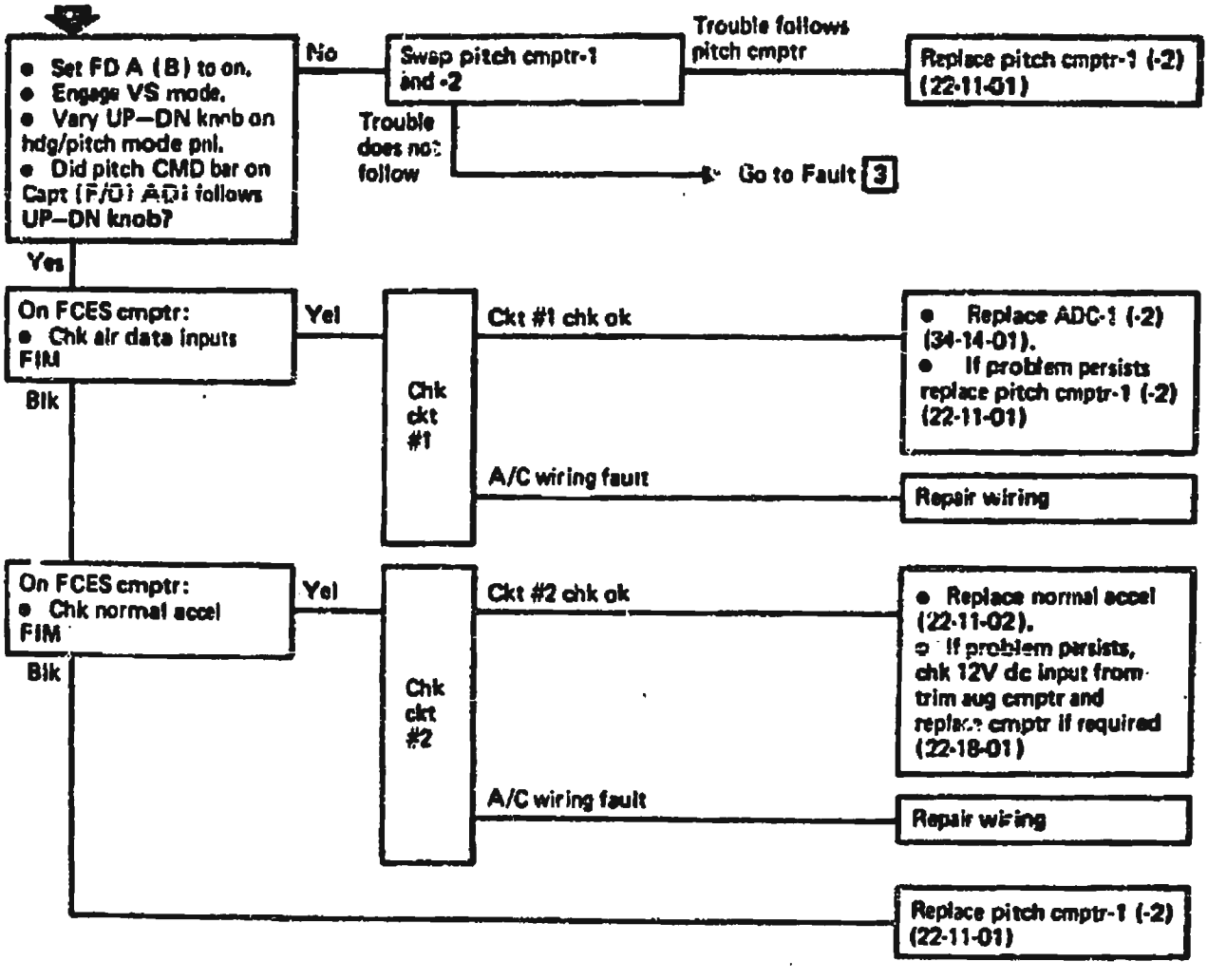
M1-0101-22-1105

FD VS Mode Faults
Figure 104 (Sheet 2)

EFFECTIVITY: ALL

001B

11	WITH AUTOPILOT A (B) TURNED ON AND VS MODE ENGAGED, THE AIRCRAFT CLIMBS OR DESCENDS AT A DIFFERENT RATE (AS INDICATED ON THE VERTICAL SPEED INDICATOR) THAN THE VS SELECTED ON THE HEADING/PITCH MODE PANEL. WHEN THE OTHER AUTOPILOT IS ENGAGED, AIRCRAFT CLIMB AND DESCENT IS NORMAL. CAPT AND F/O ADI CMD BARS DO NOT TRACK TOGETHER IN EITHER CASE.

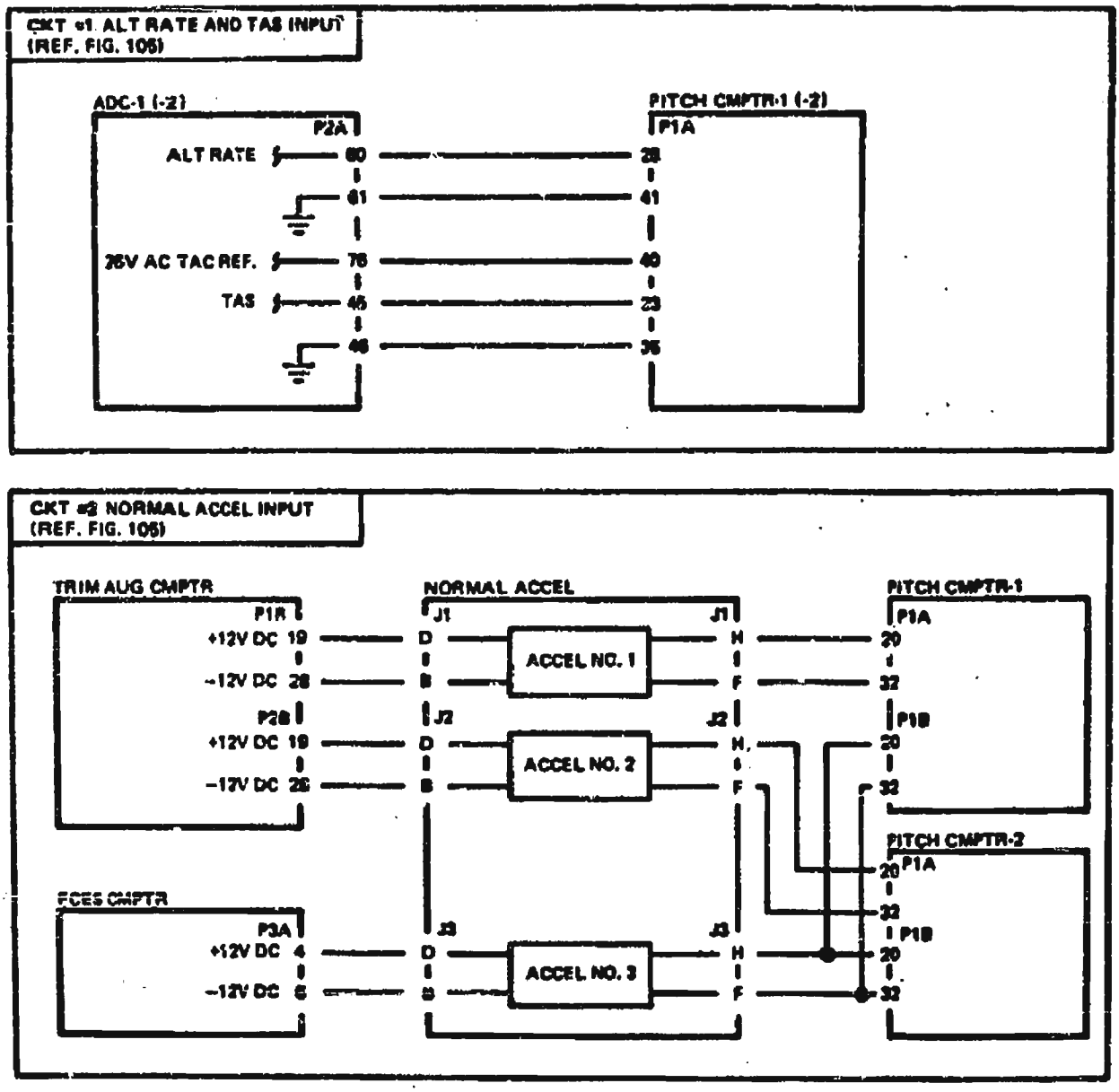

• Set FD A (B) to on.
• Engage VS mode.
• Vary UP—DN knob on hdg/pitch mode pnl.
• Did pitch CMD bar on Capt (F/O) ADI follows UP—DN knob?
No
Swap pitch cmptr-1 and -2
Trouble follows pitch cmptr
Replace pitch cmptr-1 (-2) (22-11-01)
Trouble does not follow
Go to Fault 3
Yes
On FCES cmptr:
• Chk air data inputs FIM
Blk
Yel
Chk ckt #1
Ckt #1 chk ok
• Replace ADC-1 (-2) (34-14-01).
• If problem persists replace pitch cmptr-1 (-2) (22-11-01)
A/C wiring fault
Repair wiring
On FCES cmptr:
• Chk normal accel FIM
Blk
Yel
Chk ckt #2
Ckt #2 chk ok
• Replace normal accel (22-11-02).
• If problem persists, chk 12V dc input from trim sup cmptr and replace cmptr if required (22-18-01)
A/C wiring fault
Repair wiring
Replace pitch cmptr-1 (-2) (22-11-01)

M1-0102-22-1106

R FD VS Mode Faults
R Figure 104 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

11 CONTINUED



M1-0101-22-1107

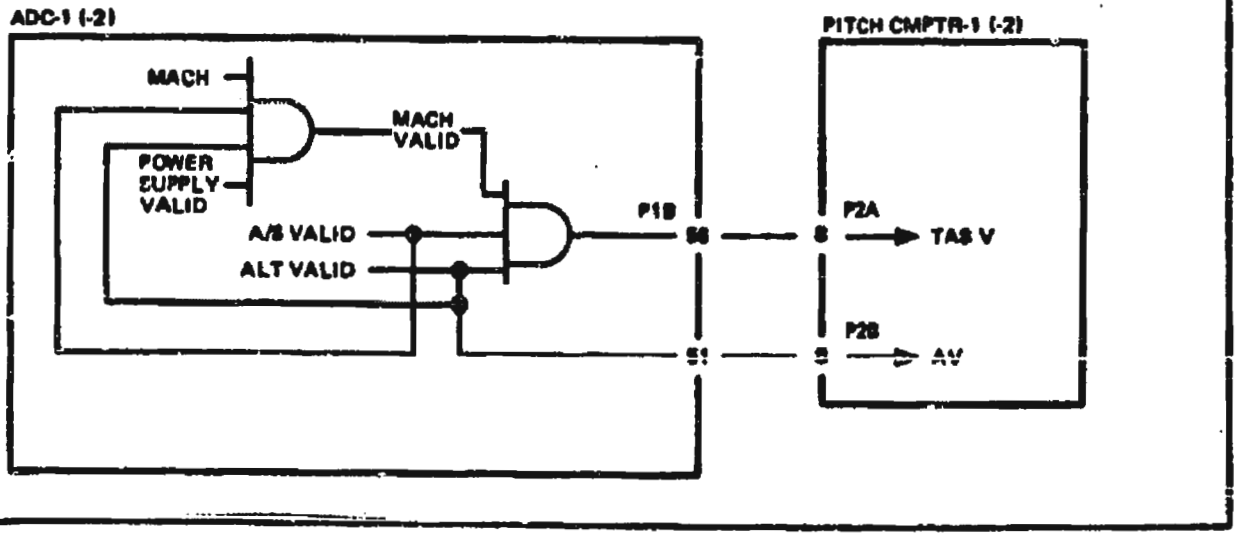
R FD VS Mode Faults
R Figure 104 (Sheet 4)

R EFFECTIVITY: ALL
R
001B

12	FD FLAG IN-VIEW, CMD BAR OUT-OF-VIEW ON CAPT (F/O) ADI. BOTH FD ARE ENGAGED IN VS MODE. AP (SAME SIDE) DROPS FROM CMD TO CWS (CMD DISC) IF TURNED ON

Chk ckt #1
Ckt #1 chk ok
A/C wiring fault
• Replace pitch cmptr-1 (-2) (22-11-01).
• If problem persists, replace ADC-1 (-2) (34-14-01)
Repair wiring

CKT #1 TAS AND ALT VALID SIGNALS (REF. FIG. 106)



NOTE

For Firm codes followed by -2 use LRU in parenthesis ( ).

M1-0102-22-1108

FD VS Mode Faults
Figure 104 (Sheet 5)

EFFECTIVITY: ALL

13 "VS" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN. BOTH FD ARE ENGAGED IN "VS" MODE. CMD BAR (SAME SIDE) FOLLOWS THUMBWHEEL IN PITCH

Mode ann fault

On Capt (F/O) AFCS modes ann:
- Depress TEST 1 sw.
- VS message is displayed on AFCS modes ann.
- VS light (on hdg/pitch mode pnl) comes on

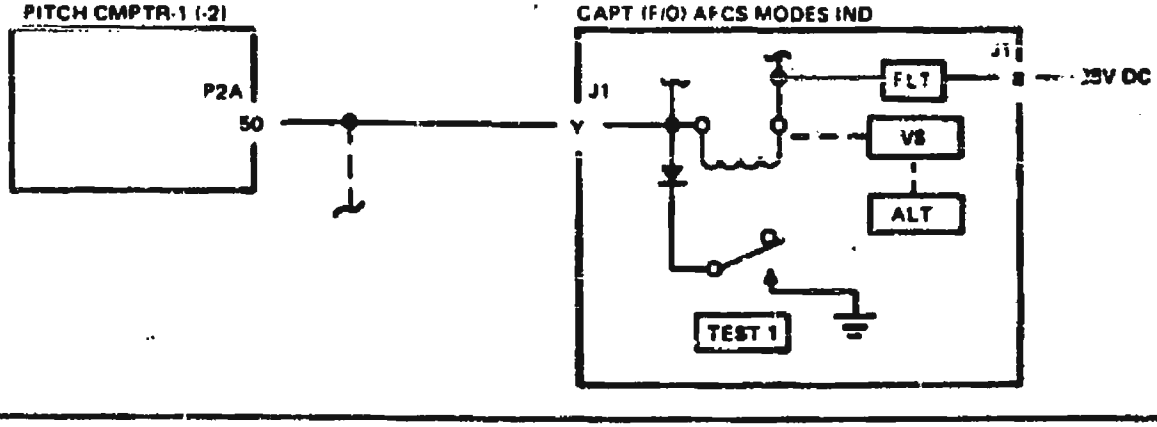
No "VS" message → Replace Capt (F/O) AFCS modes ann (22-10-05)

No "VS" light → Chk ckt #1
- A/C wiring fault → Repair wiring
- AFCS modes ann has inter open cht → Replace Capt (F/O) AFCS modes ann (22-10-05)

TEST 1 OK

Swap pitch cmptr-1 and -2
- Trouble follows pitch comptr → Replace pitch cmptr-1 (-2) (22-11-01)
- A/C wiring fault → Repair wiring P2A-50 to J1-Y (Ref. ckt #1)

CKT #1 VS MODE ANN (REF. FIG. 105)

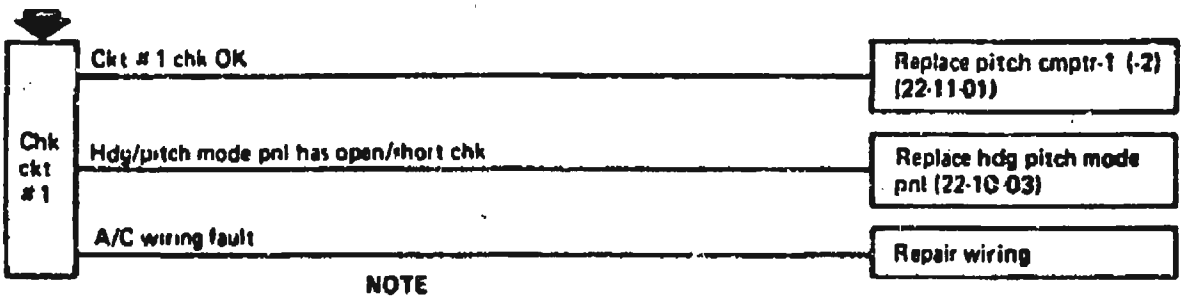


M1-0102-22-1109

FD VS Mode Faults
Figure 104 (Sheet 6)

EFFECTIVITY: ALL

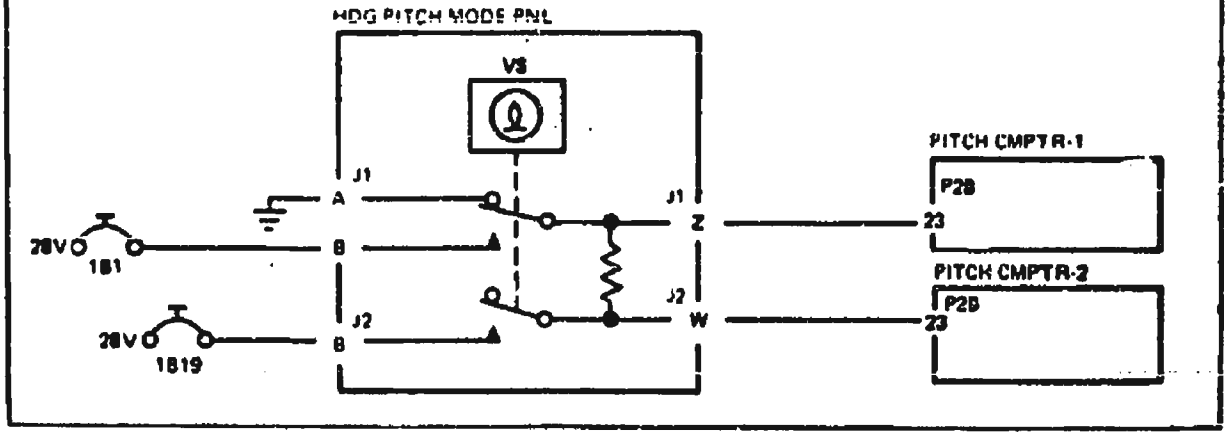
14	"VS" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "VS". MODE CMD BAR (SAME SIDE) DOES NOT FOLLOW THUMBWHEEL IN PITCH


Chk ckt #1
Ckt #1 chk OK
Replace pitch cmptr-1 (-2) (22-11-01)
Hdg/pitch mode pnl has open/short chk
Replace hdg pitch mode pnl (22-10-03)
A/C wiring fault
Repair wiring

NOTE

For FIRM codes followed by 2, use LRU in parenthesis ( ).

CKT #1 VS ENGAGE SIGNAL (REF. FIG. 106)

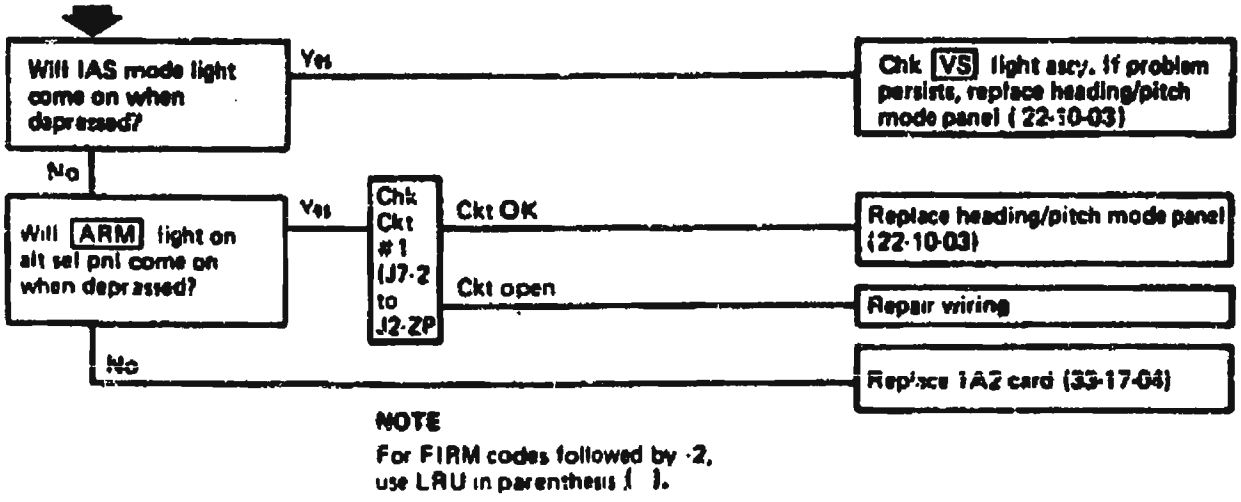


M1--0102--22--1110

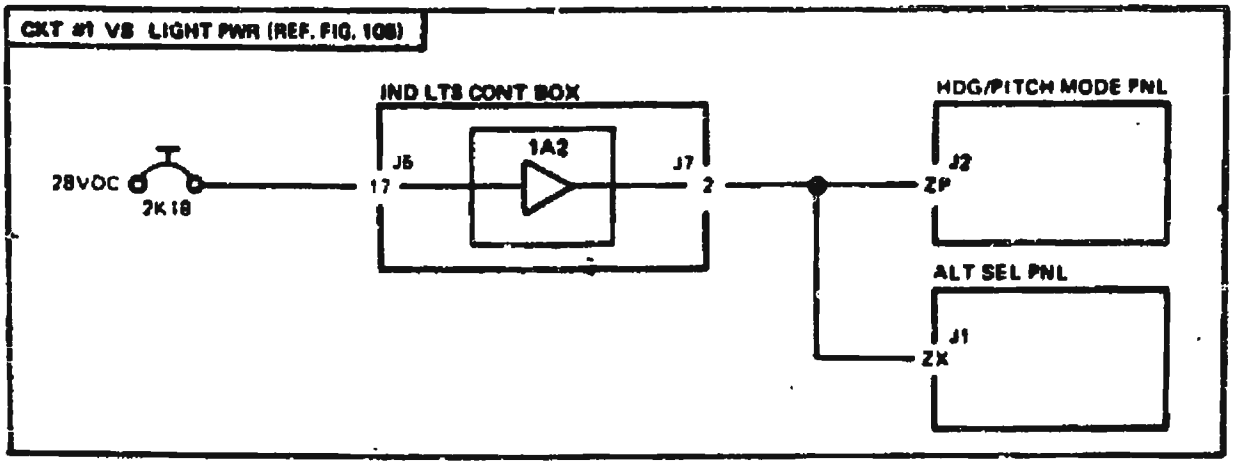
R FD VS Mode Faults
R Figure 104 (Sheet 7)

R EFFECTIVITY: ALL
R
C01B

15 VS MODE LIGHT DOES NOT COME ON WHEN DEPRESSED. VS MESSAGES IN-VIEW


Will IAS mode light come on when depressed?
Yes
Chk VS light assy. If problem persists, replace heading/pitch mode panel (22-10-03)
No
Will ARM light on alt sel pnl come on when depressed?
Yes
Chk Ckt #1 (J7-2 to J2-ZP)
Ckt OK
Replace heading/pitch mode panel (22-10-03)
Ckt open
Repair wiring
No
Replace 1A2 card (33-17-04)

NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( ).

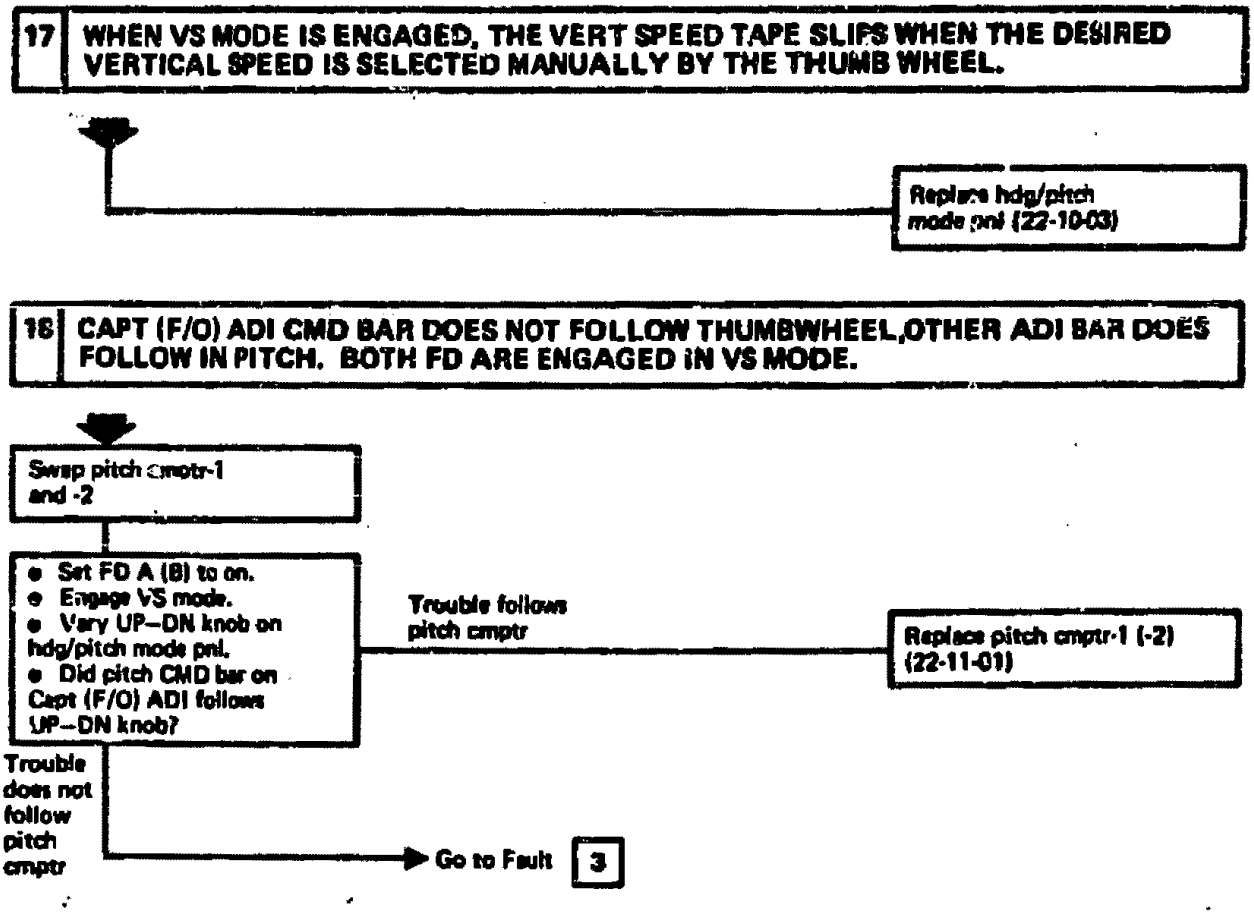


16 BOTH ADI CMD BARS DO NOT FOLLOW THUMBWHEEL (WHEEL SPINS FREE). BOTH FD ARE ENGAGED IN VS MODE. IF EITHER AUTOPILOT IS ENGAGED, UNABLE TO CONTROL RATE OF CLIMB

M1-0103-22-1111

R FD VS Mode Faults
R Figure 104 (Sheet 8)

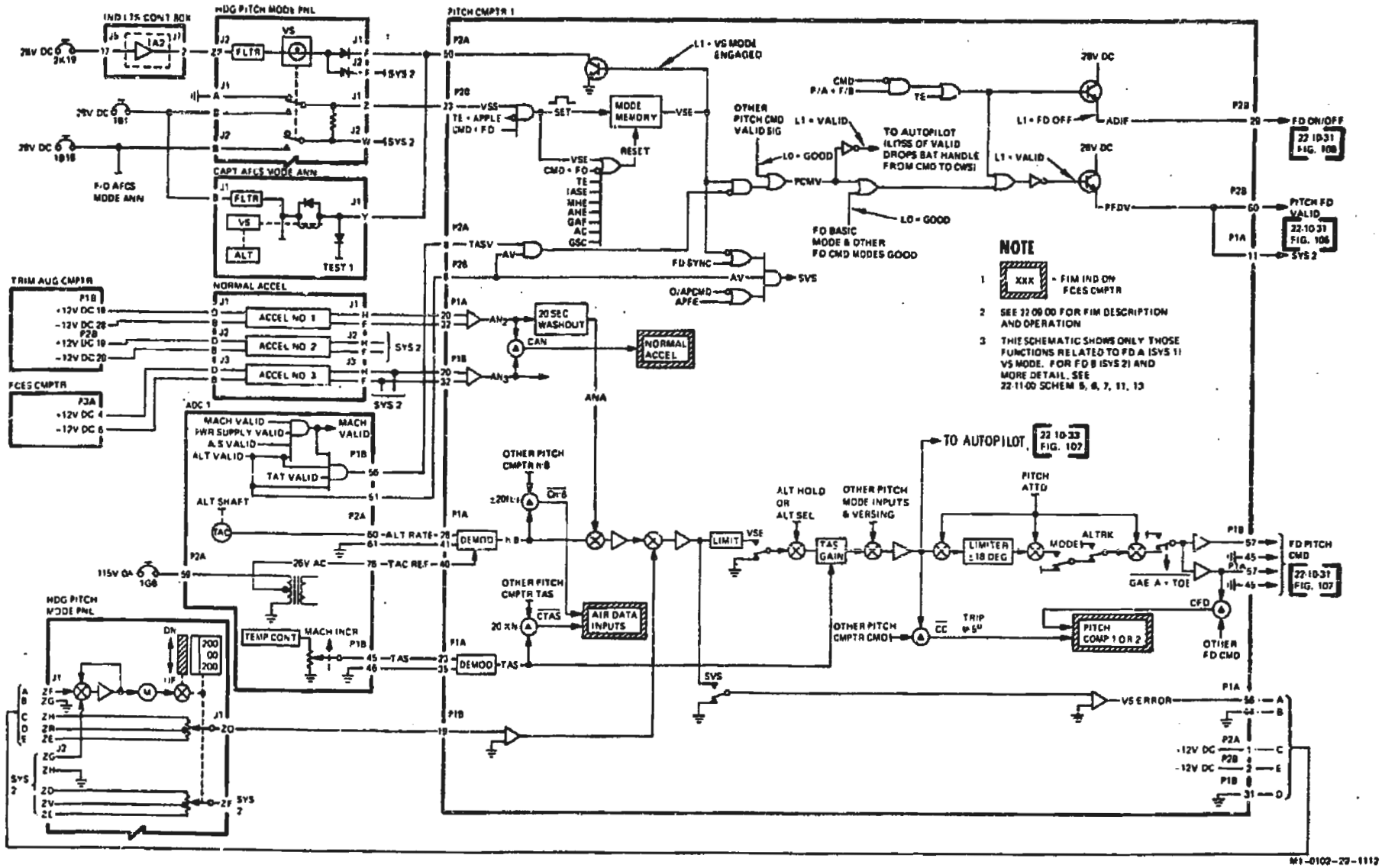
R EFFECTIVITY: ALL
R
001B


17
WHEN VS MODE IS ENGAGED, THE VERT SPEED TAPE SLIPS WHEN THE DESIRED VERTICAL SPEED IS SELECTED MANUALLY BY THE THUMB WHEEL.
Replace hdg/pitch mode pnl (22-10-03)
16
CAPT (F/O) ADI CMD BAR DOES NOT FOLLOW THUMBWHEEL,OTHER ADI BAR DOES FOLLOW IN PITCH. BOTH FD ARE ENGAGED IN VS MODE.
Swap pitch cmptr-1 and -2
• Set FD A (B) to on.
• Engage VS mode.
• Vary UP–DN knob on hdg/pitch mode pnl.
• Did pitch CMD bar on Capt (F/O) ADI follows UP–DN knob?
Trouble follows pitch cmptr
Replace pitch cmptr-1 (-2) (22-11-01)
Trouble does not follow pitch cmptr
Go to Fault 3

M1-0100-22-124

R FD VS Mode Faults
R Figure 104 (Sheet 9)

R EFFECTIVITY: ALL
R
001B



FD VS Mode Simplified Schematic
Figure 105

EFFECTIVITY: ALL

0018

R # FD VERTICAL SPEED MODE - ADJUSTMENT AND TEST

R 1. General

R The fault detection test procedure in Paragraph 4 is used in
R conjunction with the fault isolation procedure in Paragraph 5.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 5 for appropriate fault isolation.

R 2. Equipment and Materials

R Type MB-1 Pitot/Static Field Tester, Burton 2024B Pitot/Static
R Tester, or equivalent

R 3. Referenced Procedures

R 22-12-00 APFDS Modes of Operation - Maintenance Practices

R 22-12-01 AFCS Lamps and Annunciators - Fault Isolation

R 22-12-03 Flight Director Basic Mode - Fault Isolation

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00, maintenance
R practices.

R B. FD Vertical Speed Mode Test

R NOTE: Wind conditions may cause VERT SPEED tape motion.

R (1) On HEADING/PITCH MODE panel, verify that VERT SPEED
R tape indicates zero FPM.

R (2) On APFDS ENGAGE panel, set both FD switches to ON.

R RESULT:

R On both ADIs, FD flags are out of view and command
R bars are centered and level.

R (3) On HEADING/PITCH MODE panel, depress VS switchlight to
R on.

R RESULT:

R On both AFCS MODES annunciators, VS messages are
R displayed.

R On both ADIs, FD flags are out of view, and
R command bars are centered and level.

R (4) On HEADING/PITCH MODE panel, set VERT SPEED thumbwheel
R for a plus 1,000 FPM (blue background) indication.

R RESULT:

R On both ADIs, command bars move up.

R (5) If not connected, connect air data testers to CADC
R systems No. 1 and 2. On each tester, establish a
R vertical speed of plus 1,000 (up) FPM.

R RESULT:

R On both ADIs, command bars move to center.

R (6) On galley ceiling, zone 135, carefully remove normal
R accelerometer from ceiling with cables connected.

R (7) Tilt normal accelerometer 90 degrees in nose down
R direction.

R RESULT:

R On both ADIs, command bars move up.

R (8) Reinstall normal accelerometer in mount.

R (9) Depress VS switchlight to off.

R (10) Set both FD switches to OFF.

R (11) On each air data tester, establish zero vertical speed,
R and ambient altitude.

R 5. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R FD Vertical Speed Mode Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
4B(1)	VERT SPEED indicator not zero on HEADING/PITCH MODE panel	(1)
4B(2)	ADI fault isolation	(2)
4B(3)-1	VS switchlight not illuminated	(3)
4B(3)-2	VS message not displayed on Capt AFCS MODES annunciator	(4)
4B(3)-3	VS message not displayed on F/O AFCS MODES annunciator	(5)
4B(3)-4	Capt ADI FD flag displayed	(6)
4B(3)-5	Capt ADI command bar not centered	(7)
4B(3)-6	F/O ADI FD flag displayed	(8)
4B(3)-7	F/O ADI command bar not centered	(9)
4B(4)-1	Capt ADI command bar motion incorrect	(10)
4B(4)-2	F/O ADI command bar motion incorrect	(11)
4B(5)-1	Capt ADI command bar not centered	(12)
4B(5)-2	F/O Command bar not centered	(13)
4B(7)-1	Capt ADI command bar does not move up	(14)

FD Vertical Speed Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(7)-2	F/O ADI command bar does not move up	(15)
4B(9)	VS switchlight does not go dark	(16)

Schematic for Fault Isolation of FD Vertical Speed Mode Problem
Table 502

TITLE	LOCATION
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem. 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem. 6
Turbulence, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic Schematic	22-11-00, Schem 13

R B. FD Vertical Speed Mode Faults

R (1) Fault: VERT SPEED indicator not at zero

R (a) On Capt MACH/AIRSPEED indicator, is AS flag
R displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Go to Step (b).

R (b) On Capt ALTITUDE indicator, is OFF flag displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Go to Step (c).

R (c) On Capt VERTICAL SPEED indicator, is vertical
R speed reading approximately 0 FPM?

R Yes: Go to Step (d).

R No: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R (d) On F/O MACH/AIRSPEED indicator, is AS flag
R displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Go to Step (e).

R (e) On F/O ALTITUDE indicator, is OFF flag displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Go to Step (f).

R (f) On F/O VERTICAL SPEED indicator, is vertical speed
R reading approximately 0 FPM?

R Yes: Go to Step (g).

R No: Check air data system No. 2 for fault (Ref.
R 34-14-00).

R (g) On CB1, open NO. 1 SYSTEMS/PITCH & ROLL (A6) circuit breaker. Does VERT SPEED tape indicate approximately zero FPM?

R Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

R No: Go to Step (h).

R (h) On CB1, close NO. 1 SYSTEMS/PITCH & ROLL (A6) circuit breaker. Open NO. 2 SYSTEMS/PITCH & ROLL (A24) circuit breaker. Does VERT SPEED tape indicate approximately zero FPM?

R Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

R No: Replace HEADING/PITCH MODE panel (Ref. 22-10-03).

R ---

R (2) Fault: ADI fault indication

R (a) Perform Steps (1) and (2) of FD basic mode test procedure (Ref. 22-12-03).

R ---

R (3) Fault: VS switchlight not illuminated

R (a) Can mode annunciation press-to-test procedure (Ref. 22-12-01) be performed with no indicated VS switchlight fault?

R Yes: Replace HEADING/PITCH MODE panel (Ref. 22-10-03).

R No: Perform mode annunciation fault isolation procedure (Ref. 22-12-01).

R ---

R (4) Fault: On Capt AFCS MODES annunciator, VS message not displayed

R (a) Can mode annunciator press-to-test procedure (Ref. 22-12-01) be performed with no indicated VS message fault?

R Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace

R HEADING/PITCH MODE panel (Ref. 22-10-03). If
R problem persists, replace Capt AFCS MODES
R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-12-01).

R ---

R (5) Fault: On F/O AFCS MODES annunciator, VS message not
R displayed

R (a) Can mode annunciation press-to-test procedure
R (Ref. 22-12-01) be performed with no indicated VS
R message fault?

R Yes: Replace pitch computer No. 2 (Ref.
R 22-11-01). If problem persists, replace
R HEADING/PITCH MODE panel (Ref. 22-10-03). If
R problem persists, replace F/O AFCS MODES
R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-12-01).

R ---

R (6) Fault: Capt ADI FD flag displayed

R (a) On Capt ALT indicator, is OFF flag displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Go to Step (b).

R (b) On Capt MACH/AIRSPEED indicator, is AS flag
R displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Replace pitch computer No. 1 (Ref. 22-11-01).
R If problem persists, check air data system No. 1
R for fault (Ref. 34-14-00).

R ---

R (7) Fault: Capt ADI command bar not centered

R (a) On galley ceiling, zone 135, disconnect normal accelerometer No. 1 cable. On Capt ADI, is command bar centered?

R Yes: Replace normal accelerometer unit (Ref. 22-11-02).

R No: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, check air data system No. 1 for fault (Ref. 34-14-00).

R ---

R (8) Fault: F/O ADI FD flag displayed

R (a) On F/O ALT indicator, is OFF flag displayed?

R Yes: Check air data system No. 2 for fault (Ref. 34-14-00).

R No: Go to Step (b).

R (b) On F/O MACH/AIRSPEED indicator, is AS flag displayed?

R Yes: Check air data system No. 2 for fault (Ref. 34-14-00).

R No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check air data system No. 2 for fault (Ref. 34-14-00).

R ---

R (9) Fault: F/O ADI command bar not centered

R (a) On galley ceiling, zone 135, disconnect normal accelerometer No. 2 cable. On F/O ADI, is command bar centered?

R Yes: Replace normal accelerometer unit (Ref. 22-11-02).

R No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check air data system No. 2 for fault (Ref. 34-14-00).

R ---

R (10) Fault: Capt ADI command bar motion incorrect

R (a) On F/O ADI, does command bar move up?

R Yes: Go to Step (b).

R No: Replace HEADING/PITCH MODE panel (Ref. R 22-10-03).

R (b) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT R DIR switchlight to illuminate ALTN legend. On F/O R ADI, does command bar remain in approximately the R same position?

R Yes: Replace heading coupler accessory unit (Ref. R 34-22-06). If problem persists, replace Capt ADI R (Ref. 34-21-07).

R No: Go to Step (c).

R (c) On Capt INSTRUMENT SOURCE SELECT panel, depress R FLT DIR switchlight to illuminate ALTN legend. R Does Capt ADI command bar move up?

R Yes: Replace pitch computer No. 1 (Ref. R 22-11-01). If problem persists, replace heading R coupler accessory unit (Ref. 34-22-06).

R No: Replace heading coupler accessory unit (Ref. R 34-22-06).

R ----------

R (11) Fault: F/O ADI command bar motion incorrect

R (a) On Capt ADI, does command bar move up?

R Yes: Go to Step (b).

R No: Replace HEADING/PITCH MODE panel (Ref. R 22-10-03).

R (b) On Capt INSTRUMENT SOURCE SELECT panel, depress R FLT DIR switchlight to illuminate ALTN legend. On R Capt ADI, does command bar remain in approximately R the same position?

R Yes: Replace heading coupler accessory unit (Ref. R 34-22-06). If problem persists, replace F/O ADI R (Ref. 34-21-07).

R No: Go to Step (c).

R (c) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT R DIR switchlight to illuminate ALTN legend. Does R F/O ADI command bar move up?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

No: Replace heading coupler accessory unit (Ref. 34-22-06).

---

(12) Fault: Capt ADI command bar not centered

(a) On F/O ADI, is command bar approximately centered?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, check air data system No. 1 for fault (Ref. 34-14-00).

No: Replace HEADING/PITCH MODE panel (Ref. 22-10-03).

---

(13) Fault: F/O ADI command bar not centered

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, check air data system No. 2 for fault (Ref. 34-14-00).

R

---

(14) Fault: Capt ADI command bar does not move up

(a) Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace normal accelerometer unit (Ref. 22-11-02).

---

(15) Fault: F/O ADI command bar does not move up

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace normal accelerometer unit (Ref. 22-11-02).

---

(16) Fault: VS switchlight does not go dark

R (a) On Capt AFCS MODES indicator, is VS message
R displayed?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01). If problem persists, replace
R HEADING/PITCH MODE panel (Ref. 22-10-03).

R No: Replace pitch computer No. 2 (Ref. 22-11-01).
R If problem persists, replace HEADING/PITCH MODE
R panel (Ref. 22-10-03).

R ---

FD ALTITUDE HOLD MODE - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting FD altitude hold mode faults are included in this section of the manual. A FD altitude hold mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use FD altitude hold mode fault matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the FD altitude hold mode fault isolation diagram and schematics. Figures 101 and 102 provide component location for FD altitude hold mode troubleshooting.

A. General

FD altitude hold mode fault isolation contains two levels of troubleshooting: (1) fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2) trouble shoots a specific FD altitude hold mode problem. System oriented fault isolation (Ref. 22-11-33, Page 501) tests and trouble shoots FD altitude hold mode problems.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the FD altitude hold mode by a
R specific fault number. It also identifies and locates the
R LRU which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-11-33, Page 501) to isolate problem.

R Figure 104 provides diagnostic steps to further isolate the
R fault. The diagnostic steps are in a flow chart form which
R contain complete fault isolation procedures for each fault.
R Action instructions are contained within the blocks of the
R flow chart while the monitored results of the actions are
R outside the blocks. When using the flow charts, it is
R assumed that systems are in the normal operational mode, all
R relevant circuit breakers have been checked, and all
R applicable aircraft operational procedures have been
R accomplished.

R Fault Isolation Diagrams and Schematic List
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	FD Altitude Hold Mode Fault Matrix
104	FD Altitude Hold Mode Faults
105	FD Altitude Hold Mode Simplified Schematic
22-11-00 SCHEM 5	Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic
22-11-00 SCHEM 6	Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic
22-11-00 SCHEM 14	Altitude Arm Capture, and Hold Mode Engage Logic Schematic

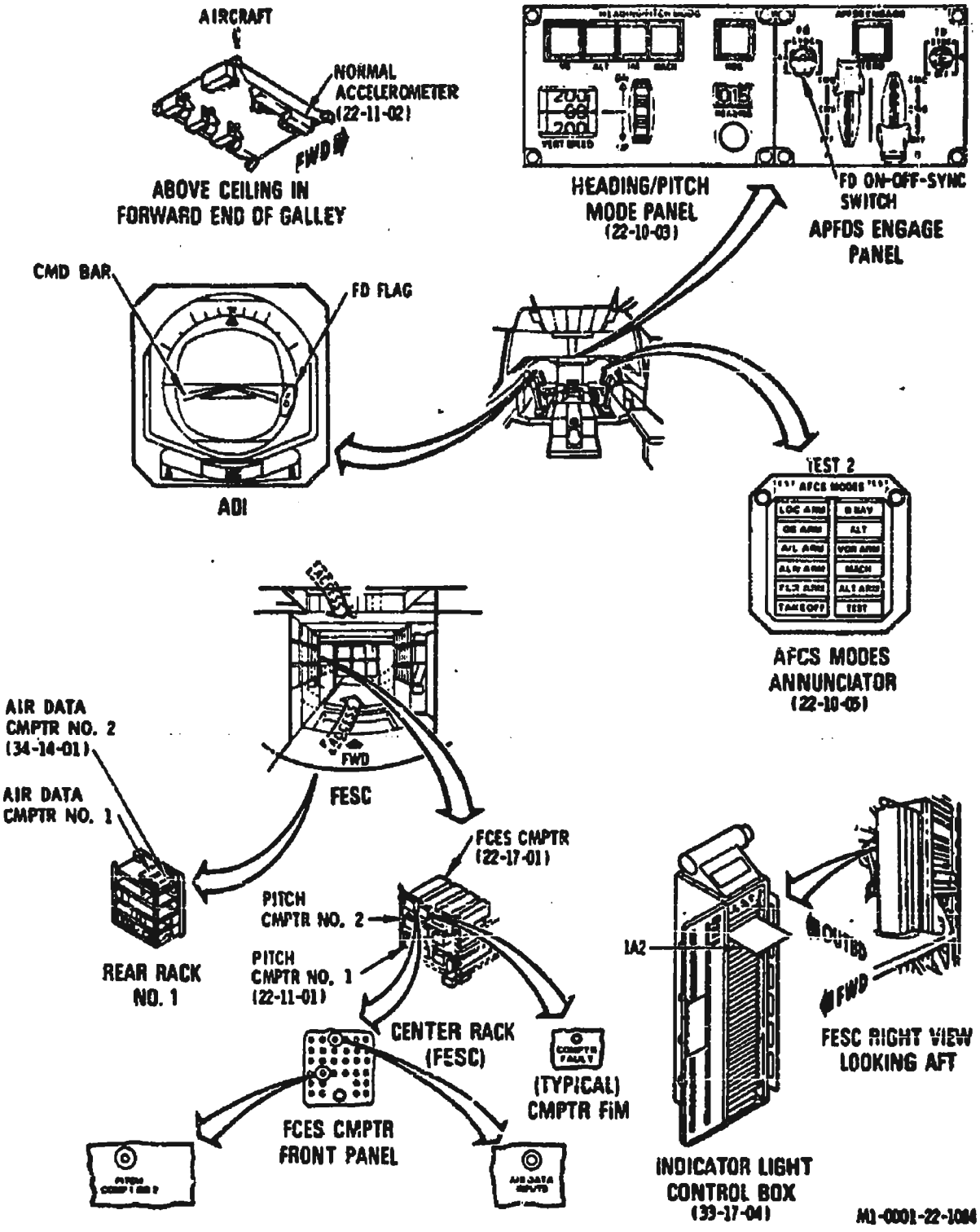
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCELEROMETER – NORMAL	1	[illegible]ALY CLG/135DB	22-11-02
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
CONTROL BOX – INDICATOR LIGHTS CARD 1A2	1	FESC/112AB	33-17-04
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05
PANEL – HEADING/PITCH MODE COMMAND	1	FLT STA, GLRSHLD PNL	22-10-03
SERVO – STABILIZER AUTOPILOT CONTROL	1	AFTERBODY/316DR	22-11-05
WHEEL – CONTROL	2	FLT STA	27-11-01

M1-0000-22-2150

Component Location Index
Figure 101

EFFECTIVITY: ALL

001B



R FD Altitude Hold Mode Fault Identification
R Figure 102

R EFFECTIVITY: ALL
R
001B

"ALT HOLD MODE ENGAGED – BOTH FD ON AND BOTH AP OFF" (Ref. Fig. 104)

No.	FAULTS: Problem (Capt or F/O)	FIM: Troubleshooting Faulty LRU — Check FIM on LRU or on Front Panel of FCES Cmptr: ADC	PC	NA	AP SERVO	TAC	NO FIM: Continuity Check or Replace: CW	HDG/PITCH PNL	ILCB CARD	MODES ANN
1	Capt (F/O) ADI CMD bar does not follow other ADI in pitch when both FD are engaged in "ALT HOLD" mode	1/2	1/2	X	X	X	1/2			
2	FD flag in-view, CMD bar out-of-view on Capt (F/O) ADI when both FD are engaged in "ALT HOLD" mode. AP (same side) drops from CMD or CWS to OFF (CMD DISC) if turned on	1/2	1/2							
3	"ALT" mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in "ALT HOLD" mode. ADI CMD bar (same side) follows other ADI bar in pitch		1/2							1/2
4	"ALT" mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in "ALT HOLD" mode. ADI CMD bar (same side) does not follow other ADI bar in pitch		1/2					X		
5	ALT mode light does not come on when depressed								1A2	

Abbreviations		Remove and Install Ref. Chapt.	Page
ADC	Air Data Computer	34-14-01	401
AP SERVO	Stabilizer AP Control Servo	22-11-05	401
CW	Control Wheel	27-11-01	401
HDG/PITCH PNL	Heading/Pitch Mode Panel	22-10-03	401
ILCB CARD	Indicator Lights Control Box Card	33-17-00	401
MODES ANN	AFCS Modes Annunciator	22-10-05	401
NA	Normal Accelerometer	22-11-02	401
PC	Pitch Computer	22-11-01	401

HOW TO USE:

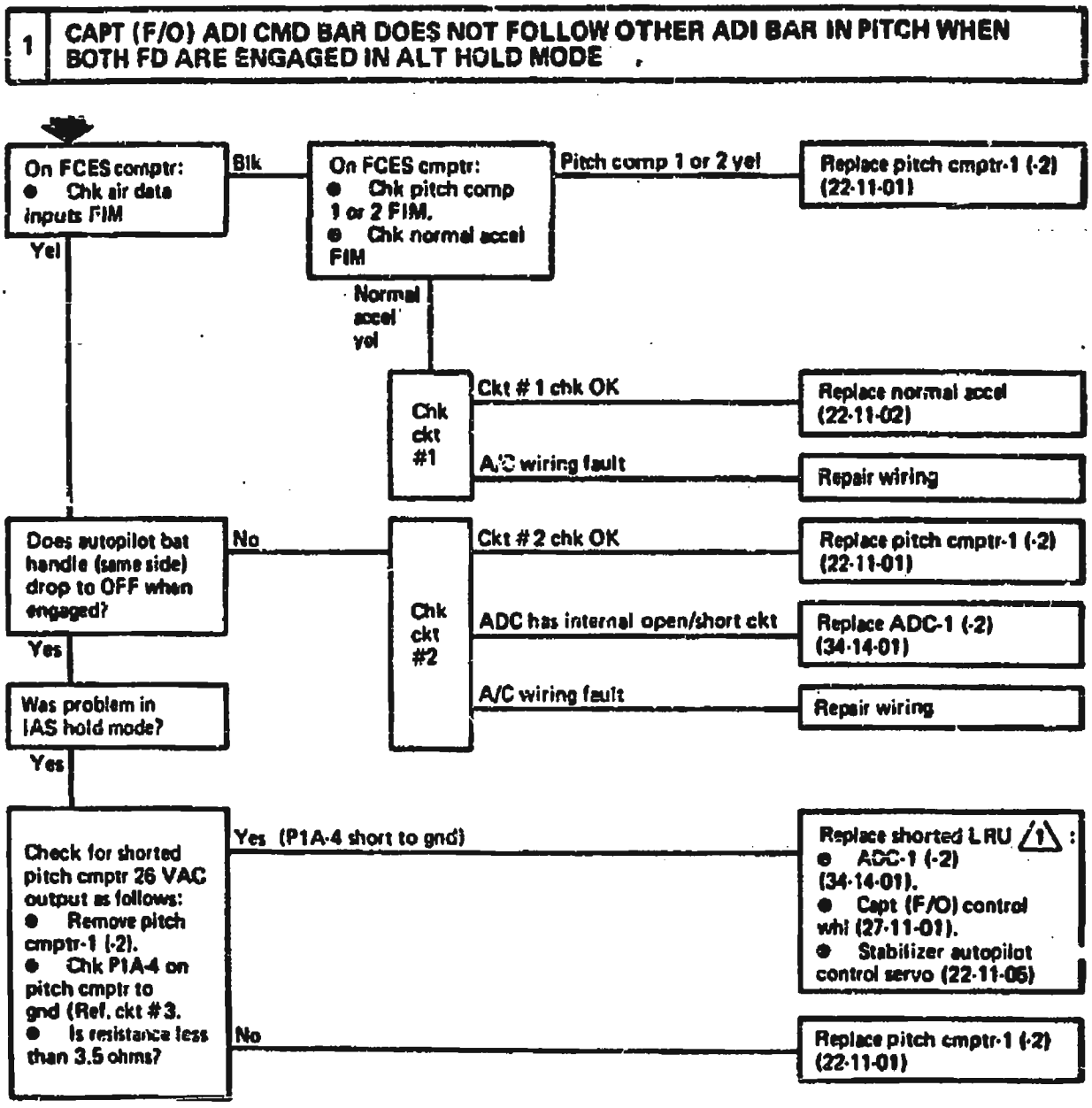
1. Find flight squawk in FAULTS column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 102

M1–0001–22–1089

R R FD Altitude Hold Mode Fault Matrix
Figure 103

R R EFFECTIVITY: ALL

001B


1 CAPT (F/O) ADI CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN PITCH WHEN BOTH FD ARE ENGAGED IN ALT HOLD MODE
On FCES comptr:
● Chk air data inputs FIM
Blk
On FCES cmptr:
● Chk pitch comp 1 or 2 FIM.
● Chk normal accel FIM
Pitch comp 1 or 2 yel
Replace pitch cmptr-1 (-2) (22-11-01)
Yel
Normal accel yel
Chk ckt #1
Ckt # 1 chk OK
Replace normal accel (22-11-02)
A/C wiring fault
Repair wiring
Does autopilot bat handle (same side) drop to OFF when engaged?
No
Chk ckt #2
Ckt # 2 chk OK
Replace pitch cmptr-1 (-2) (22-11-01)
ADC has internal open/short ckt
Replace ADC-1 (-2) (34-14-01)
A/C wiring fault
Repair wiring
Yes
Was problem in IAS hold mode?
Yes
Check for shorted pitch cmptr 26 VAC output as follows:
● Remove pitch cmptr-1 (-2).
● Chk P1A-4 on pitch cmptr to gnd (Ref. ckt #3.
● Is resistance less than 3.5 ohms?
Yes (P1A-4 short to gnd)
Replace shorted LRU /1\ :
● ADC-1 (-2) (34-14-01).
● Capt (F/O) control whl (27-11-01).
● Stabilizer autopilot control servo (22-11-05)
No
Replace pitch cmptr-1 (-2) (22-11-01)

/1\ NOTE
Replace pitch cmptr-1 (-2) after faulted (shorted) LRU is replaced.

2 For FIRM codes followed by -2, use LRU in parenthesis ( ).

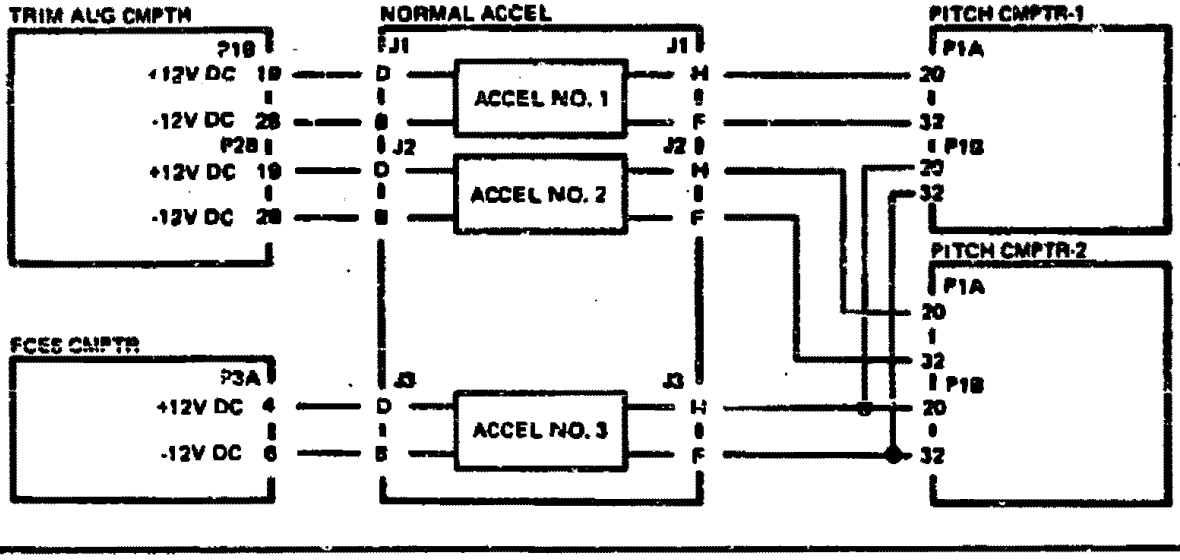
M1-0100-22-1000

R FD Altitude Hold Mode Faults
R Figure 104 (Sheet 1)

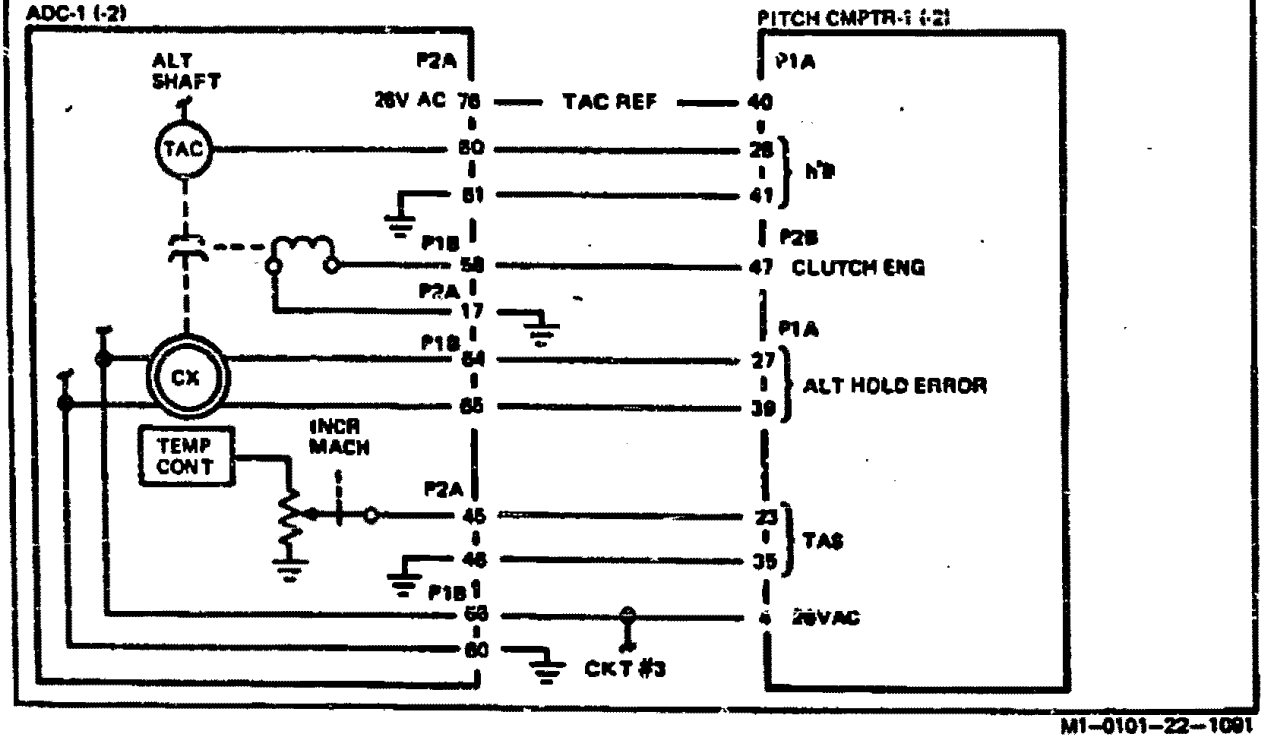
R EFFECTIVITY: ALL
R
001B

1 CONTINUED

CKT #1 NORMAL ACCEL INPUT (REF. FIG. 106)



CKT #2 ADC-1 (-2) INPUT AND CLUTCH ENGAGE (REF. FIG. 105)

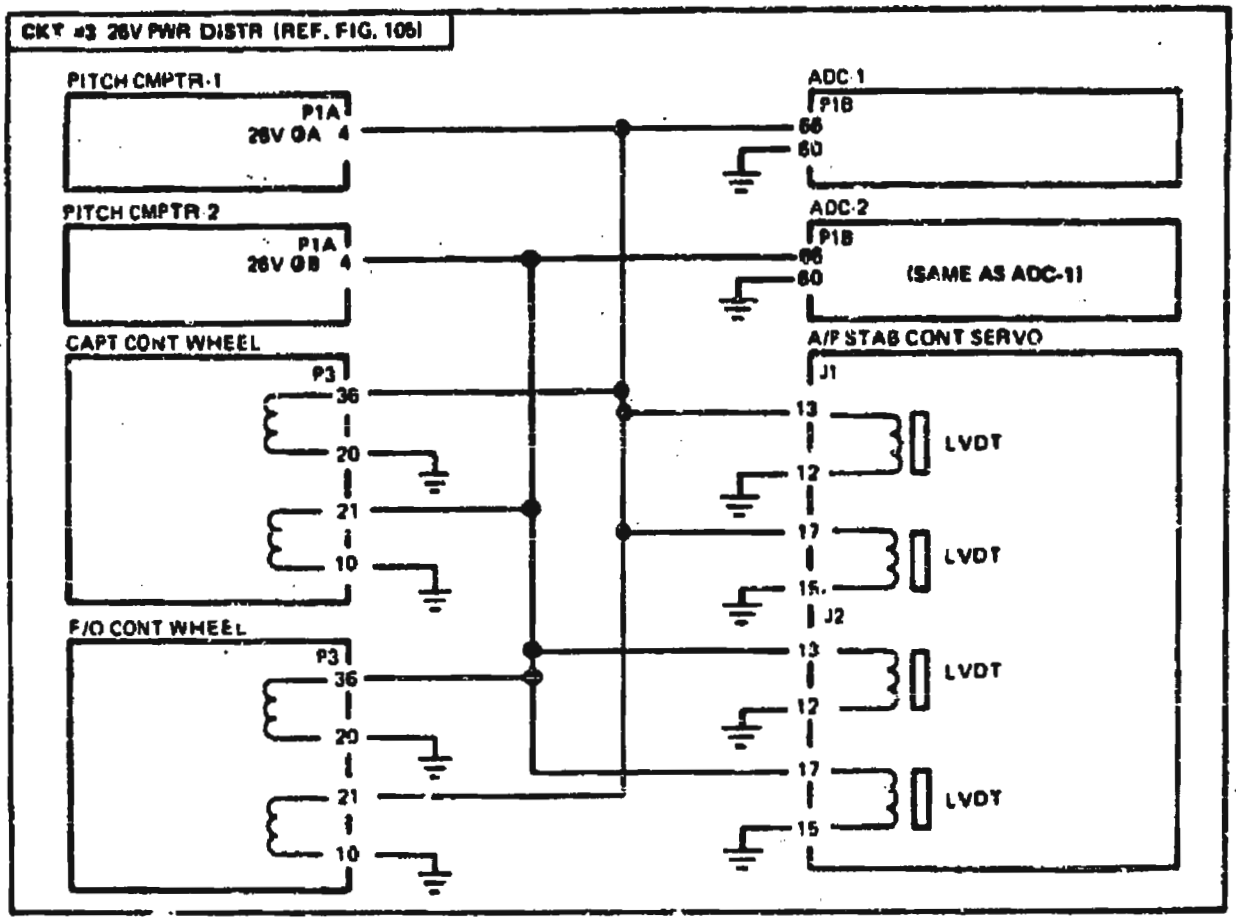


M1-0101-22-1091

R FD Altitude Hold Mode Faults
R Figure 104 (Sheet 2)

R EFFECTIVITY: ALL
R
0018

1 CONTINUED

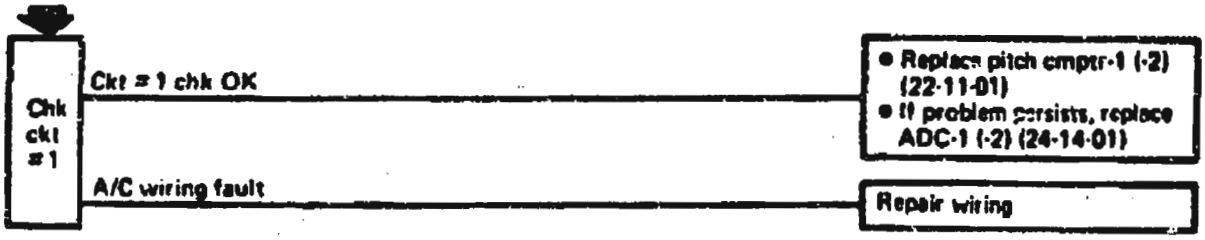


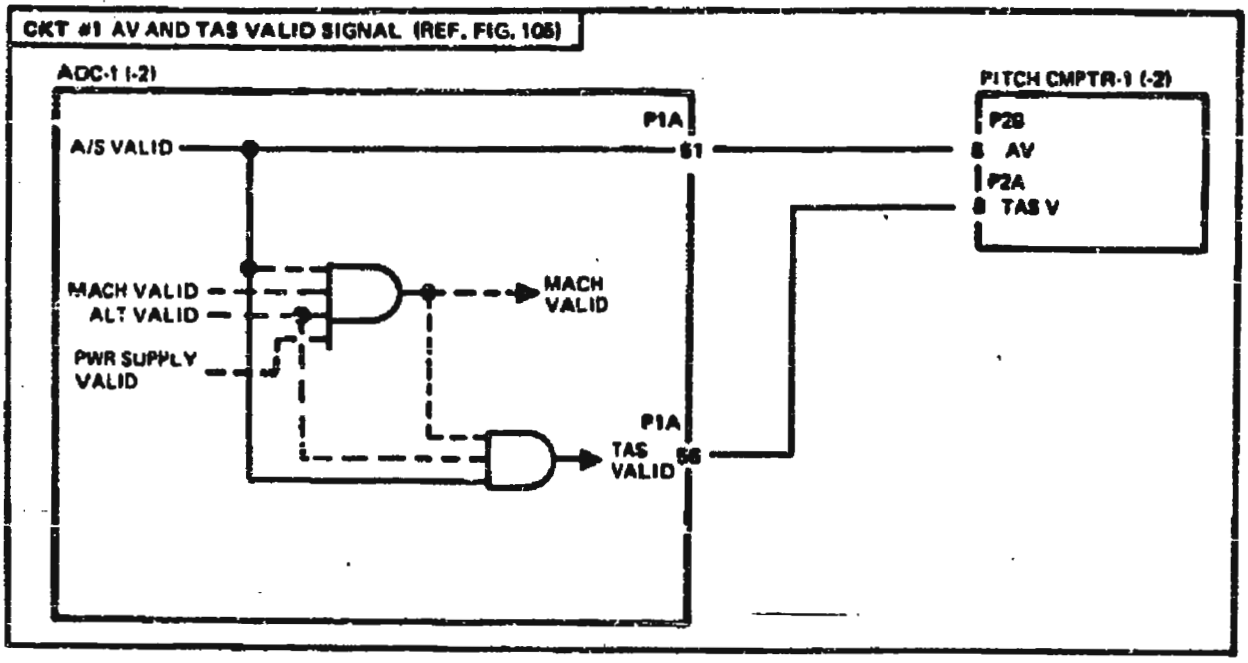
M1-0101-22-1092

R FD Altitude Hold Mode Faults
R Figure 104 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

2	FD FLAG-IN-VIEW, CMD BAR OUT-OF-VIEW ON CAPT (F/O) ADI WHEN BOTH FD ARE ENGAGED IN "ALT HOLD" MODE. AP (SAME SIDE) DROPS FROM CMD OR CWS TO OFF (CMD DISC) IF TURNED ON


Chk ckt #1
Ckt #1 chk OK
A/C wiring fault
• Replace pitch cmptr-1 (-2) (22-11-01)
• If problem persists, replace ADC-1 (-2) (24-14-01)
Repair wiring



NOTE

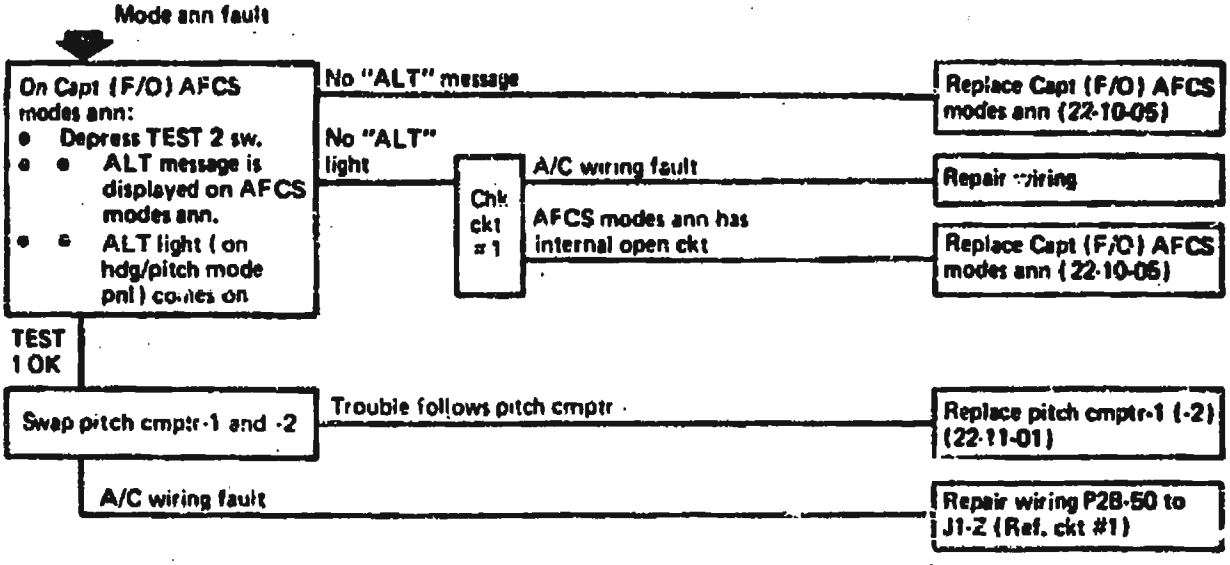
For FIRM codes followed by -2 use LRU in parenthesis ( )

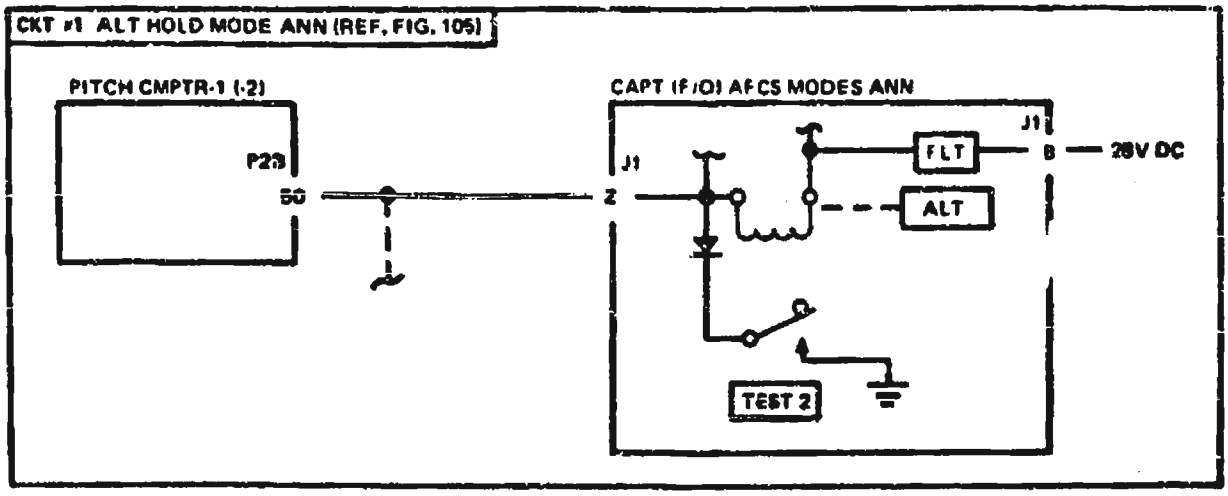
M1-0102-22-1093

R FD Altitude Hold Mode Faults
R Figure 104 (Sheet 4)

R EFFECTIVITY: ALL
R
001B

3	"ALT" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "ALT HOLD" MODE. CMD BAR (SAME SIDE) FOLLOWS OTHER CMD BAR IN PITCH


Mode ann fault
On Capt (F/O) AFCS modes ann:
• Depress TEST 2 sw.
• • ALT message is displayed on AFCS modes ann.
• • ALT light (on hdg/pitch mode pnl) comes on
No "ALT" message
Replace Capt (F/O) AFCS modes ann (22-10-05)
No "ALT" light
Chk ckt #1
A/C wiring fault
Repair wiring
AFCS modes ann has internal open ckt
Replace Capt (F/O) AFCS modes ann (22-10-05)
TEST 1 OK
Swap pitch cmptr-1 and -2
Trouble follows pitch cmptr
Replace pitch cmptr-1 (-2) (22-11-01)
A/C wiring fault
Repair wiring P28-50 to J1-Z (Ref. ckt #1)

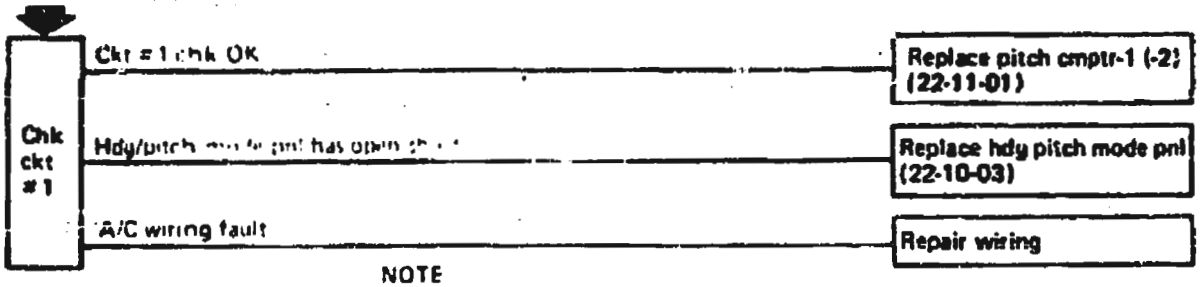


M1-0101-22-1084

R FD Altitude Hold Mode Faults
R Figure 104 (Sheet 5)

R EFFECTIVITY: ALL

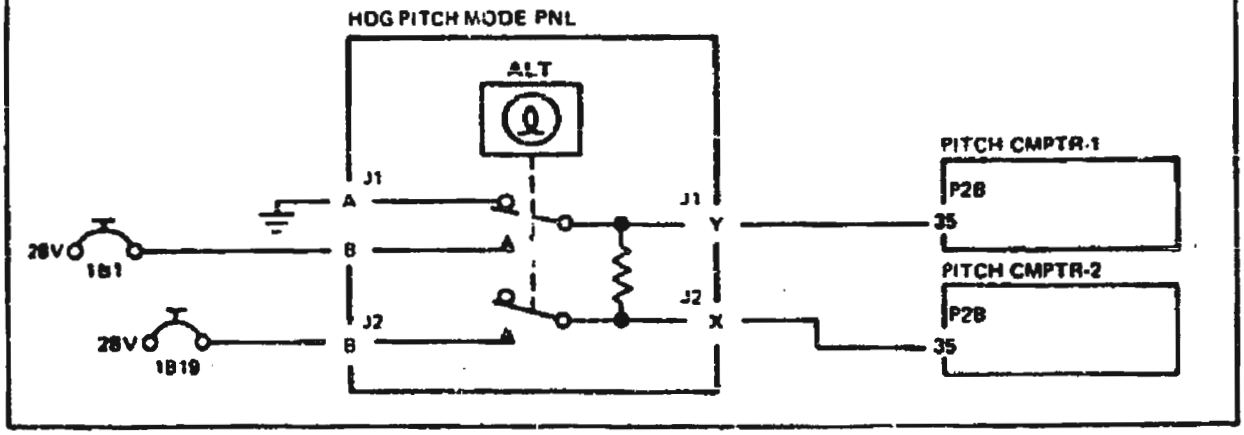
4	"ALT" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "ALT HOLD" MODE. CMD BAR (SAME SIDE) DOES NOT FOLLOW OTHER CMD BAR IN PITCH


Chk ckt #1
Ckt #1 chk OK
Hdg/pitch mode pnl has open ckt
A/C wiring fault
Replace pitch cmptr-1 (-2) (22-11-01)
Replace hdg pitch mode pnl (22-10-03)
Repair wiring

NOTE

For [illegible] followed by 2.
Use [illegible] in parentheses ( ).

CKT #1 ALT ENGAGE SIGNAL (REF. FIG. 105)

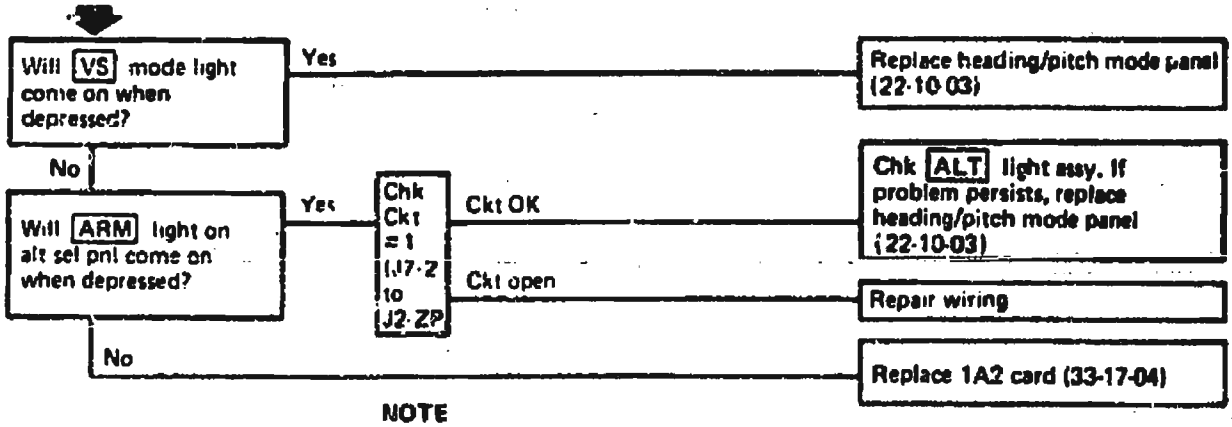


M1-0101-22-1095

R R FD Altitude Hold Mode Faults
Figure 104 (Sheet 6)

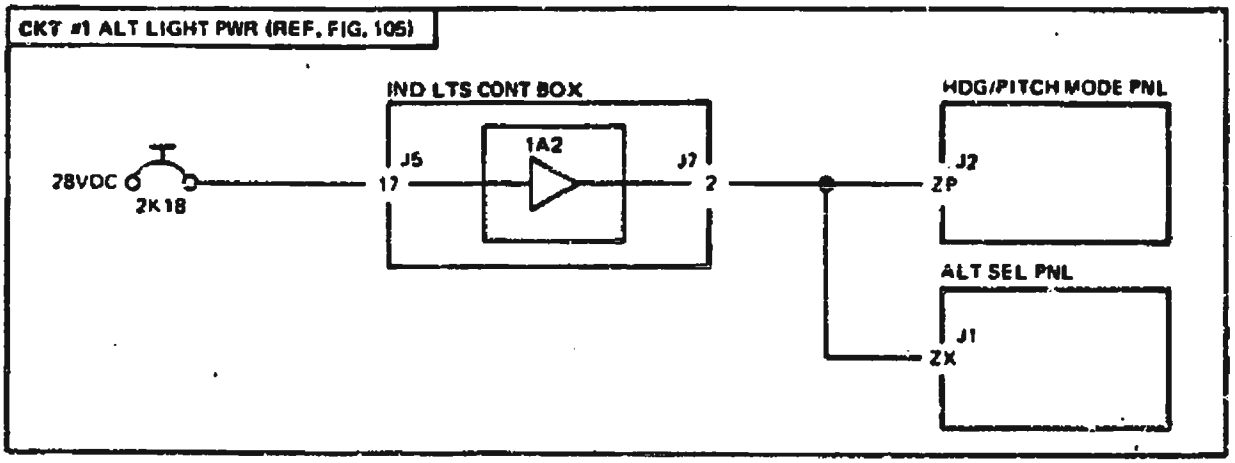
R R 001B EFFECTIVITY: ALL

5 ALT MODE LIGHT DOES NOT COME ON WHEN DEPRESSED. ALT MESSAGES IN-VIEW


Will VS mode light come on when depressed?
Yes
Replace heading/pitch mode panel (22-10-03)
No
Will ARM light on alt sel pnl come on when depressed?
Yes
Chk Ckt # 1 J17-Z to J2-ZP
Ckt OK
Chk ALT light assy. If problem persists, replace heading/pitch mode panel (22-10-03)
Ckt open
Repair wiring
No
Replace 1A2 card (33-17-04)

NOTE

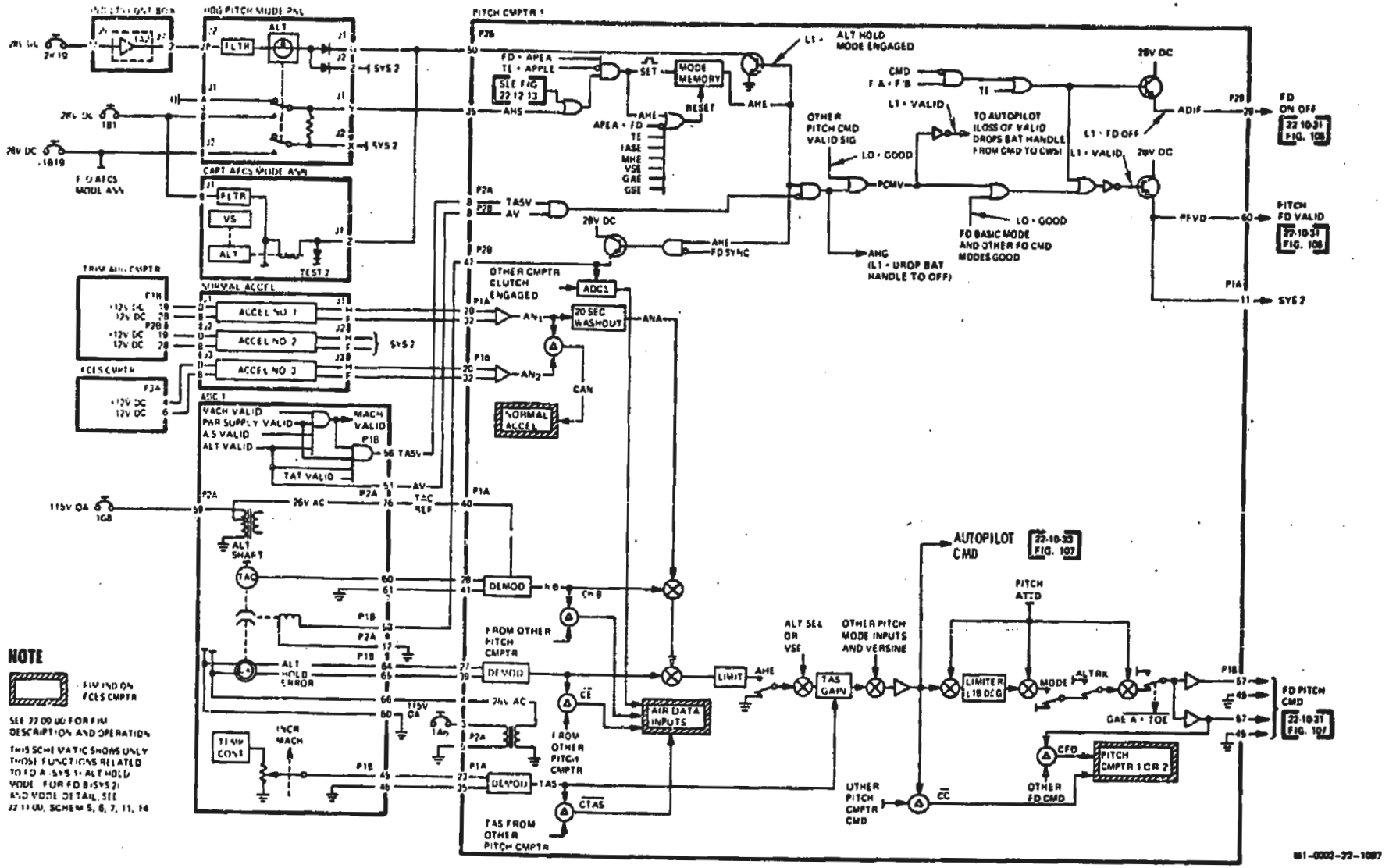
For FIRM codes followed by 2, use LRU in parenthesis ( ).



M1-0102-22-1098

R FD Altitude Hold Mode Faults
R Figure 104 (Sheet 7)

R EFFECTIVITY: ALL
R
001B



R FD Altitude Hold Mode Simplified Schematic
R Figure 105

R EFFECTIVITY: ALL

0018

FD ALTITUDE HOLD MODE - ADJUSTMENT AND TEST

1. General

The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for appropriate fault isolation.

2. Equipment and Materials

Type MB-1 Pitot/Static Field Tester, Burton 2024B Pitot/Static Tester, or equivalent

3. Referenced Procedures

	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	Flight Director Basic Mode - Fault Isolation

4. Fault Detection Test

A. Preliminary Procedures

(1) Turn on APFDS as described in 22-12-00, maintenance practices.

B. FD Altitude Hold Mode Test

(1) On APFDS ENGAGE panel, set both FD switches to ON.

RESULT:

Both ADI command bars come into view and are level.

Both ADI FD flags are out of view.

(2) On HEADING/PITCH MODE panel, depress ALT switchlight to on.

RESULT:

On both AFCS MODES annunciators, ALT messages are displayed.

On both ADI's FD flags are out of view, and command bars are centered.

(3) Depress ALT switchlight to off.

RESULT:

ALT messages are removed.

(4) If not connected, connect air data testers to CADC systems No. 1 and 2. On each tester, establish an airspeed of 130 knots at ambient altitude.

(5) Depress ALT switchlight to on.

RESULT:

Both ALT messages are displayed.

Both FD flags are out of view, and both command bars are centered.

(6) On both air data testers, increase altitude 200 feet above ambient altitude.

RESULT:

On both ADI's, command bars move down.

(7) On both air data testers, increase airspeed to 250 knots.

RESULT:

On both ADI's, command bars move toward center.

(8) On CB1, open AIR DATA CMPTR (G8) and (G27) circuit breakers.

RESULT:

R On both ADI, FD flags are displayed, and command bars are biased out of view.

(9) Close G8 and G27 circuit breakers.

(10) On each air data tester, establish zero airspeed and ambient altitude.

(11) Set both FD switches to OFF.

R 5. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, references to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R FD Altitude Hold Mode Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
4B(1)	ADI fault indication	(1)
4B(2)-1	ALT switchlight not illuminated	(2)
4B(2)-2	ALT message not displayed on Capt AFCS MODES annunciator	(3)
4B(2)-3	ALT message not displayed on F/O AFCS MODES annunciator	(4)
4B(2)-4	Capt ADI FD flag displayed	(5)
4B(2)-5	Capt ADI command bar not centered	(6)
4B(2)-6	F/O ADI FD flag displayed	(7)
4B(2)-7	F/O ADI command bar not centered	(8)
4B(3)	ALT switchlight remains illuminated	(9)
4B(6)-1	Capt ADI command bar motion incorrect	(10)
4B(6)-2	F/O ADI command bar motion incorrect	(11)
4B(7)-1	Capt ADI command bar does not move	(12)
4B(7)-2	F/O ADI command bar does not move	(13)
4B(8)-1	No Capt ADI fault indication	(14)

FD Altitude Hold Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(8)-2	No F/O ADI fault indication	(15)

Schematics for Fault Isolation of FD Altitude Hold Mode Problem
Table 502

TITLE	LOCATION
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00 Schem 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
Altitude Arm Capture, and Hold Mode Engage Logic Schematic	22-11-00, Schem 14

B. FD Altitude Hold Faults

(1) Fault: ADI fault indication

R (a) Perform Steps (1) and (2) of FD basic mode test procedure (Ref. 22-10-31).

---

(2) Fault: ALT switchlight not illuminated

R (a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ALT switchlight fault?

Yes: Replace HEADING/PITCH MODE panel (Ref. 22-10-03).

R No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

---

(3) Fault: On Capt AFCS MODES annunciator, ALT message not displayed

R (a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ALT message fault?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

---

(4) Fault: ALT message not displayed on F/O AFCS MODES annunciator

R (a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ALT message fault?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If

R problem persists, replace F/O AFCS MODES
R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref 22-12-01).

R ---

R (5) Fault: Capt ADI FD flag displayed

R (a) On Capt ALTITUDE indicator, is OFF flag displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Go to Step (b).

R (b) On Capt MACH/AIRSPEED indicator, is AS flag
R displayed?

R Yes: Check air data system No. 1 for fault (Ref.
R 34-14-00).

R No: Replace pitch computer No. 1 (Ref. 22-11-01).
R If problem persists, check air data system No. 1
R for fault (Ref. 34-14-00).

R ---

R (6) Fault: Capt ADI command bar not centered

R (a) On galley ceiling,, zone 135, disconnect normal
R accelerometer No. 1 cable. On Capt ADI, is
R command bar centered?

R Yes: Replace normal accelerometer unit (Ref.
R 22-11-02).

R No: Replace pitch computer No. 1 (Ref. 22-11-01).
R If problem persists, check air data system No. 1
R for fault (Ref. 34-14-00).

R ---

R (7) Fault: F/O ADI FD flag displayed

R (a) On F/O ALTITUDE indicator, is OFF flag displayed?

R Yes: Check air data system No. 2 for fault (Ref.
R 34-14-00).

R No: Go to Step (b).

(b) On Capt MACH/AIRSPEED indicator, is AS flag displayed?

Yes: Check air data system No. 2 for fault (Ref. 34-14-00).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check air data system No. 2 for fault (Ref. 34-14-00).

---

(8) Fault: F/O ADI command bar not centered

(a) On galley ceiling,, zone 135, disconnect normal accelerometer No. 2 cable. On F/O ADI, is command bar centered?

Yes: Replace normal accelerometer unit (Ref. 22-11-02).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check air data system No. 2 for fault (Ref. 34-14-00).

---

(9) Fault: ALT switchlight remains illuminated

(a) On Capt AFCS MODES annunciator, is ALT message displayed?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03).

---

(10) Fault: Capt ADI command bar motion incorrect

(a) Does command bar remain in view?

Yes: Go to Step (b).

No: Go to Step (c).

R (b) Can vertical speed mode test procedure (Ref. 22-11-31) be performed with no indicated faults?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, check air data system No. 1 for fault (Ref. 34-14-00).

No: Perform vertical speed mode fault isolation
R procedure (Ref. 22-11-31).

(c) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. On F/O ADI, does command bar command nosedown?

Yes: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace Capt ADI (Ref. 34-21-07).

No: Replace pitch computer No. 1 (Ref 22-11-01). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

---

(11) Fault: F/O ADI command bar motion incorrect

(a) On F/O ADI, does command bar remain in view?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Can vertical speed mode test procedure (Ref.
R 22-11-31) be performed with no indicated faults?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check air data system No. 2 for fault (Ref. 34-14-00).

No: Perform vertical speed mode fault isolation
R procedure (Ref. 22-11-31).

(c) On Capt INSTR SOURCE SELECT panel, depress FLT DIR ALT switchlight to illuminate ALTN legend. On Capt ADI, does command bar command nosedown?

Yes: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace F/O ADI (Ref. 34-21-07).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

R ---

R (12) Fault: Capt ADI command bar does not move

R (a) Replace pitch computer No. 1 (Ref. 22-11-01). If
R problem persists, check air data system No. 1 for
R fault (Ref. 34-14-00).

R ---

R (13) Fault: F/O ADI command bar does not move

R (a) Replace pitch computer No. 2 (Ref. 22-11-01). If
R problem persists, check air data system No. 2 for
R fault (Ref. 34-14-00).

R ---

R (14) Fault: No Capt ADI fault indication

R (a) On CB1, open NO. 1 SYSTEMS/PITCH & ROLL (A6)
R circuit breaker. On Capt ADI, is FD flag in view?

R Yes: Replace pitch computer No. 1 (Ref. 22-11-01)

R No: Replace Capt ADI (Ref. 34-21-07).

R ---

R (15) Fault: No F/O ADI fault indication

R (a) On CB1, open NO. 2 SYSTEMS/PITCH & ROLL (A24)
R circuit breaker. On F/O ADI, is FD flag in view?

R Yes: Replace pitch computer No. 2 (Ref.
R 22-11-01).

R No: Replace F/O ADI (Ref. 34-21-07).

R ---

FD ALTITUDE SELECT MODE - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting FD Altitude Select Mode faults are included in this section of the manual. An FD altitude select mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, were appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use FD altitude select mode fault matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the FD altitude select mode fault isolation diagram and schematics. Figures 101 and 102 provide component location for FD altitude select mode troubleshooting.

R A. General

FD altitude select mode fault isolation contains two levels of troubleshooting: (1) fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2B) trouble shoots a specific FD altitude select mode problem. System oriented fault isolation (Ref. 22-11-35, Page 501) tests and trouble shoots FD altitude select mode problems.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the FD altitude select mode by
R a specific fault number. It also identifies and locates the
R LRU which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-11-35, page 501) to isolate problem.

Figure 104 provides diagnostic steps to further isolate the fault. The diagnostic steps are in a flow chart form which contains complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the actions are outside the blocks. When using the flow charts, it is assumed that systems are in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

Fault Isolation Diagram and Schematic List
Table 101

	Figure	Title
	101	Component Location Index
	102	Component Locator Diagram
	103	FD Altitude Select Mode Fault Matrix
R	104	FD Altitude Select Mode Faults
	105	FD Altitude Select Mode Simplified Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – FLIGHT CONTROL ELECTRONICS SYSTEM	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
CONTROL BOX – INDICATOR LIGHTS, CARD 1A2	1	FESC, AFT OF ELEC TRACK/112AB	33-17-04
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA/CAPT AND F/O INSTR PNL	22-10-05
INDICATOR – BAROMETRIC ALTITUDE	2	FLT STA/CAPT AND F/O INSTR PNL	34-14-03
PANEL – ALTITUDE SELECT	1	FLT STA/GLARESHIELD PNL	22-11-03

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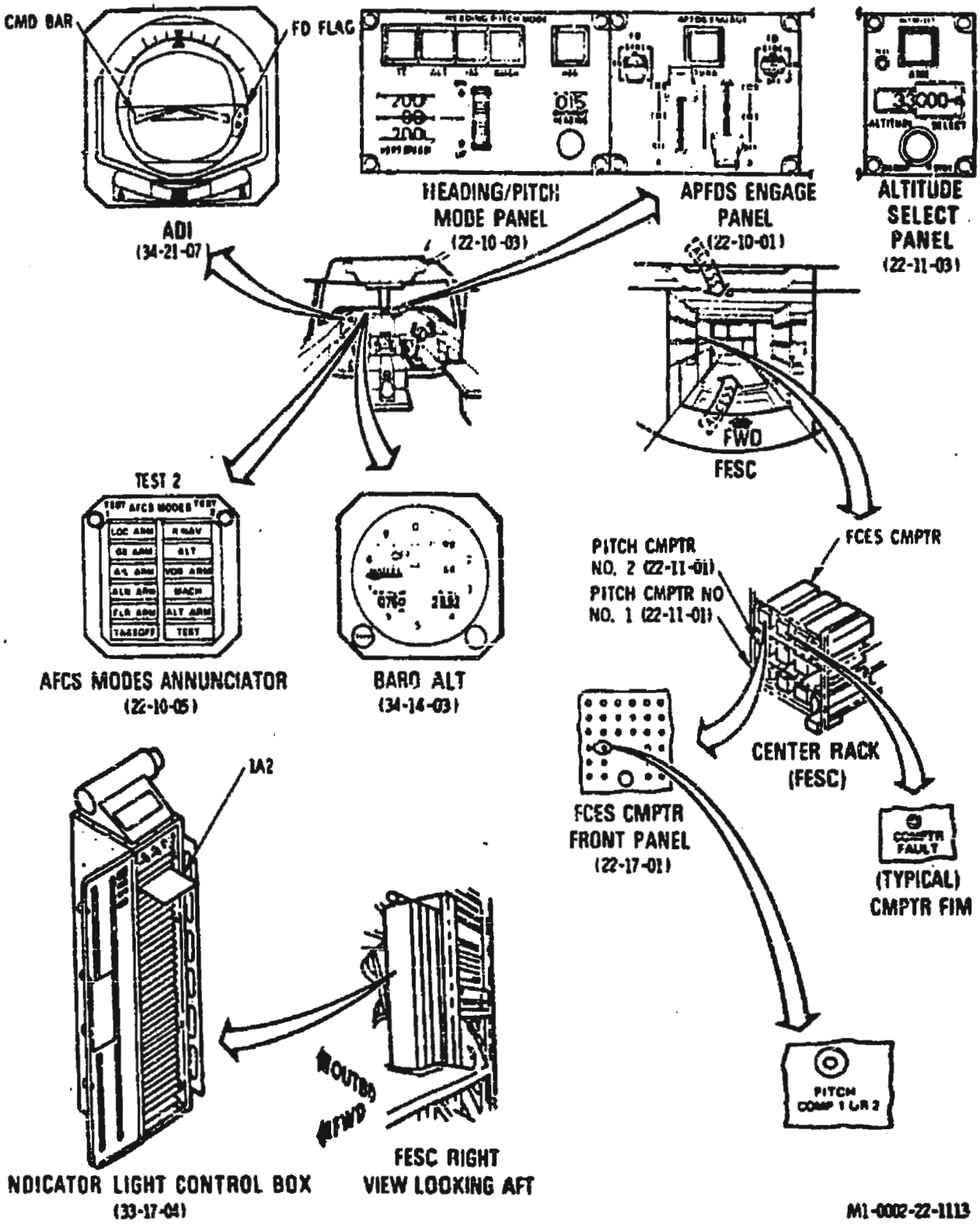
R R Component Location Index
Figure 101

R R 001B EFFECTIVITY: ALL



Component Locator Diagram
Figure 102

No.	FAULTS	FIM	NO FIM
		Troubleshooting Faulty LRU	
		Check FIM on LRU or on Front Panel of FCES Cmptr	Continuity Check or Replace
		PC / FCES	ALT SEL PNL / BARO ALT / MODES ANN / ILCB CARD
	Capt FIRM Codes With ·1 — F/O FIRM Codes With ·2; X — Use With Both FIRM Codes		
	"ALT SEL NOT ENGAGED" (Ref. Fig. 103)		
1	Altitude select knob stuck (frozen)		X
2	Flag covers altitude select window when air data source knob is set to NORM (STBY). Flag is out-of-view in other know position. STALL WARN, ATS, DLC/AUTO SPLR, ETC. (SAME SIDE) FAIL lights are on	X	
3	Flag covers altitude select window when air data source knob is set to NORM (STBY). Flag is out-of-view in other knob position. Baro altimeter (same side) has OFF-flag in-view		C/F
4	Flag covers altitude select window when air data source knob is set to NORM (STBY). Flag is out-of-view in other knob position	X	C/F
5	Flag covers altitude select window when air data source knob in both STBY and NORM positions	X	X
	"BOTH FD ON AND ALT SEL ENGAGED" (Ref. Fig. 103)		
11	Altitude other than selected altitude captured with air data source knob in NORM (STBY) position. System OK in other knob position	X	X C/F
12	Altitude select ARM light did not go out at altitude capture. ALT ARM message on Capt (F/O) AFCS modes ann. remains in-view. Other AFCS modes ann. indications OK	1/2	
13	Altitude select did not begin altitude capture and will not show capture on Capt (F/O) ADI. Other ADI indication OK	1/2	
14	Did not begin altitude capture and will not capture selected altitude with air data source knob in NORM (STBY) position. Both ADIs did not indicate level off at selected altitude	X	X C/F

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R R FD Altitude Select Mode Fault Matrix
Figure 103 (Sheet 1)

R EFFECTIVITY: ALL
R
001B

FAULTS — FIM — NO FIM

No.	Problem (Capt or F/O) Capt FIRM Codes With -1 — F/O FIRM Codes With -2 X — Use With Both FIRM Codes	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: PC	FCES	Continuity Check or Replace: ALT SEL PNL	BARO ALT	MODES ANN	ILCB CARD	FCES
"BOTH FD ON AND ALT SEL ENGAGED" CONTINUED (Ref. Fig. 104)								
15	ALT ARM mode not displayed on Capt (F/O) AFCS modes ann. when altitude arm mode is engaged. Both FD turned on.	1/2		X		C/F		
16	Altitude select ARM light does not come on when depressed with air data source knob in NORM (STBY) position. System OK in other knob position		X					
17	Altitude select ARM light does not come on when depressed with air data source knob in NORM (STBY) position. System OK in other knob position		X					
18	Altitude select ARM light comes on momentarily, then ALT hold light comes on		X					
19	ARM mode light does not come on when depressed. ALT ARM message in-view						1A2	
20	ALT ARM message drops out before capture in NORM or STBY			X				X

Abbreviation		Remove and Install Ref. Chapt.	Page
ALT SEL PNL	Altitude Select Panel	22-11-03	401
BARO ALT	Barometric Altimeter	34-14-03	401
FCES	FCES Computer	22-17-01	401
ILCB CARD	Indicator Lights Control Box Card	33-17-04	401
MODES ANN	AFCS Modes Annunciator	22-10-05	401
PC	Pitch Computer	22-11-01	401

HOW TO USE

1. Find flight squawk in FAULTS column
2. Check FIM on LRUs listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104

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R R FD Altitude Select Mode Fault Matrix
Figure 103 (Sheet 2)

R EFFECTIVITY: ALL
R
0018

1	ALTITUDE SELECT KNOB STUCK (FROZEN)

→ Replace alt sel pnl (22-11-03)

2	"FLAG" COVERS ALTITUDE SELECT WINDOW WHEN AIR DATA SOURCE KNOB IS SET TO NORM (STBY). "FLAG" IS OUT-OF-VIEW IN OTHER KNOB POSITION. STALL WARN, ATS, DLC/AUTO SPLR, ETC. (ON SAME SIDE) FAIL LIGHTS ON

→ FCES cmptr FIM whl → Replace FCES cmptr (22-17-01)

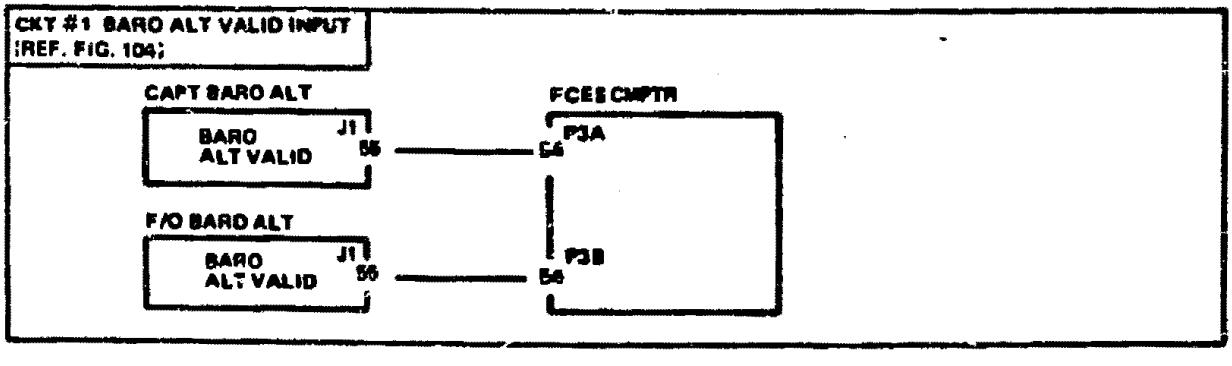
3	"FLAG" COVERS ALTITUDE SELECT WINDOW WHEN AIR DATA SOURCE KNOB IS SET TO NORM (STBY). "FLAG" IS OUT-OF-VIEW IN OTHER KNOB POSITION. BARO ALT (SAME SIDE) HAS "OFF FLAG" IN-VIEW

→ Replace Capt (F/O) baro alt (34-14-03)

4	"FLAG" COVERS ALTITUDE SELECT WINDOW WHEN AIR DATA SOURCE KNOB IS SET TO NORM (STBY). "FLAG" IS OUT-OF-VIEW IN OTHER KNOB POSITION

Chk ckt #1

- Ckt #1 chk OK → • Replace FCES cmptr (22-17-01) ○ If problem persists, replace Capt (F/O) baro alt (34-14-03)
- A/C wiring fault → Repair wiring



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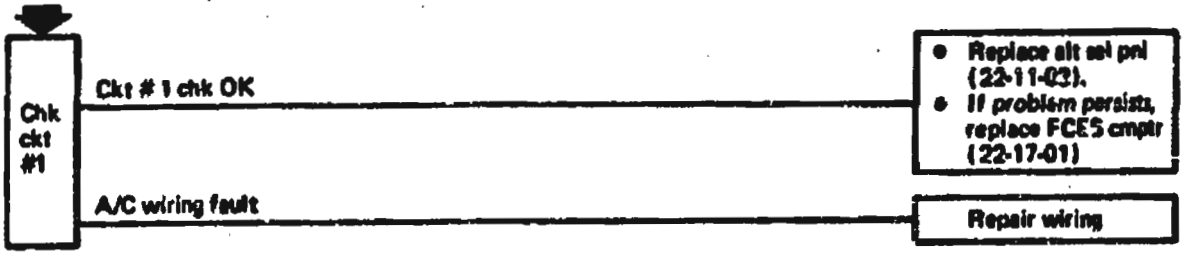
R
R

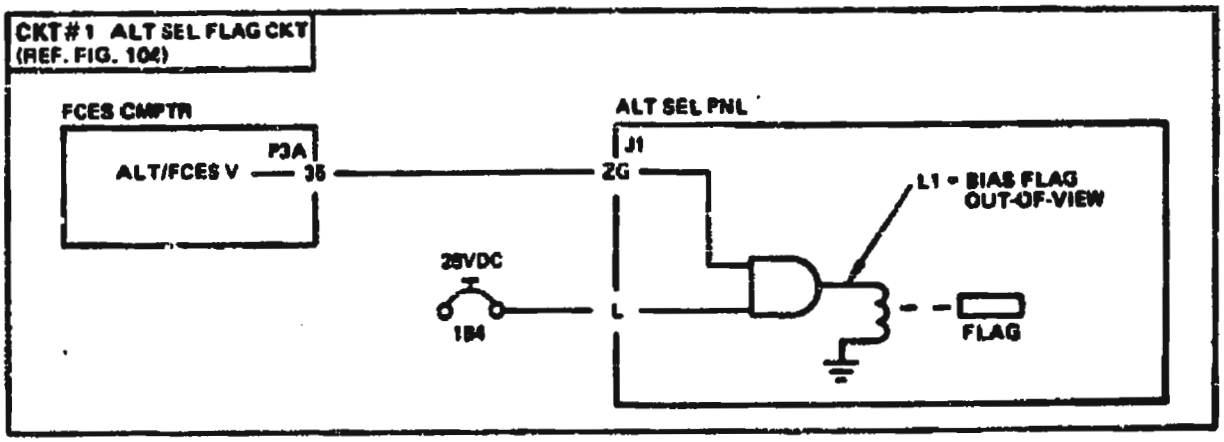
FD Altitude Select Mode Faults
Figure 104 (Sheet 1)

EFFECTIVITY: ALL

001B

5	"FLAG" COVERS ALTITUDE SELECT WINDOW WITH AIR DATA SOURCE KNOB IN BOTH NORM AND STBY POSITION. NO OTHER COCKPIT INDICATION


Chk ckt #1
Ckt # 1 chk OK
A/C wiring fault
• Replace alt sel pnl (22-11-03).
• If problem persists, replace FCES cmptr (22-17-01)
Repair wiring



M1-0001-22-1126

11	ALTITUDE OTHER THAN SELECTED ALTITUDE CAPTURED WITH AIR DATA SOURCE KNOB IN NORM (STBY) POSITION. SYSTEM NORMAL IN OTHER KNOB POSITION

- Replace FCES cmptr (22-17-01).
- If problem persists, replace alt sel rml (22-11-03).
- If problem still persists, replace Capt (F/O) baro alt (34-14-03)

12	ALTITUDE SELECT "ARM" LIGHT DID NOT GO OUT AT ALTITUDE CAPTURE. "ALT ARM" MESSAGE ON CAPT (F/O) AFCS MODES ANNUNCIATOR REMAINS IN-VIEW. OTHER AFCS MODES ANNUNCIATOR INDICATIONS NORMAL

Replace pitch cmptr-1 (-2) (22-11-01)

13	ALTITUDE SELECT DID NOT BEGIN ALTITUDE CAPTURE AND WILL NOT SHOW CAPTURE ON CAPT (F/O) ADI. OTHER ADI INDICATION NORMAL

Replace pitch cmptr-1 (-2) (22-11-01)

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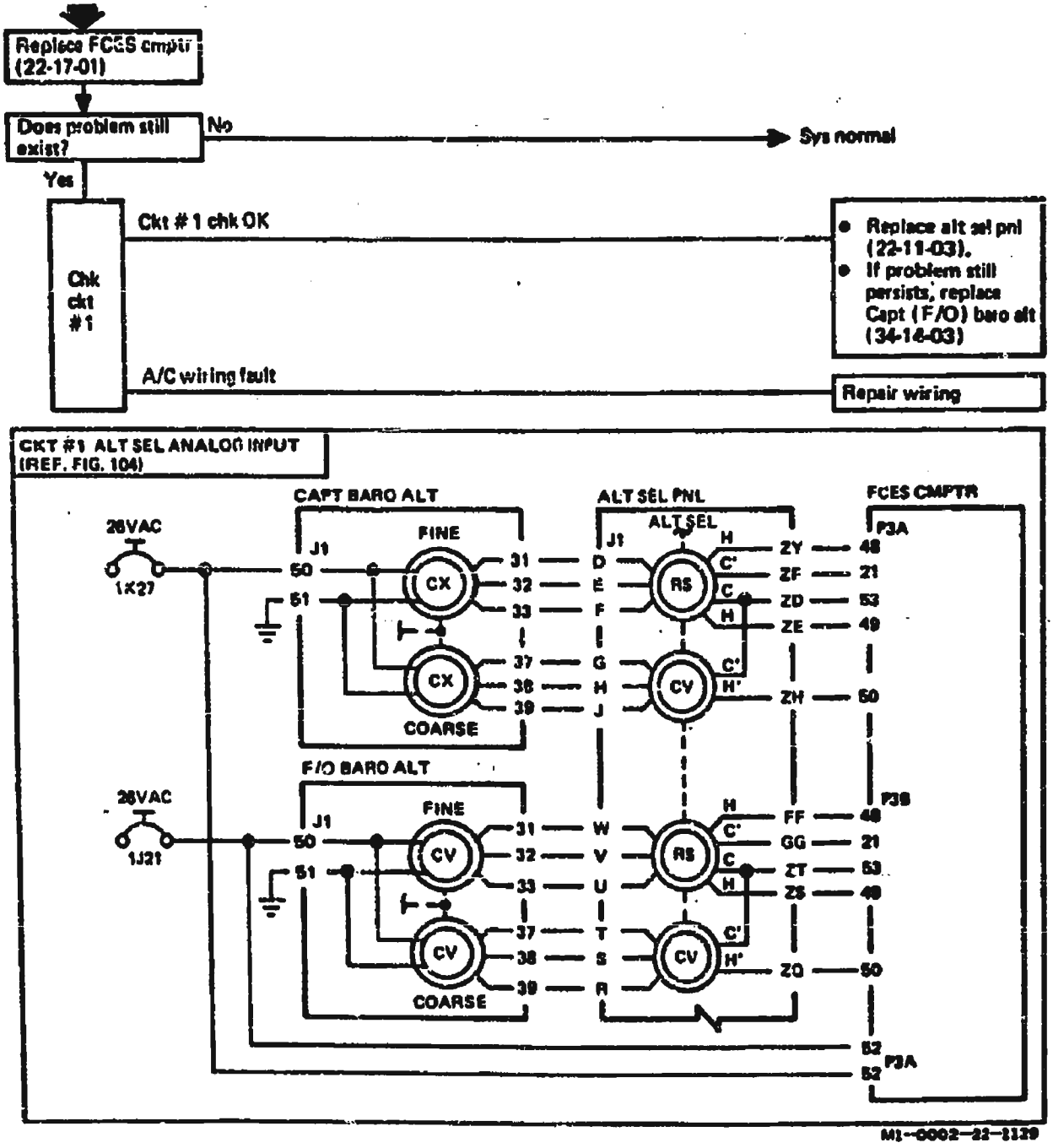
R R FD Altitude Select Mode Faults
Figure 104 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

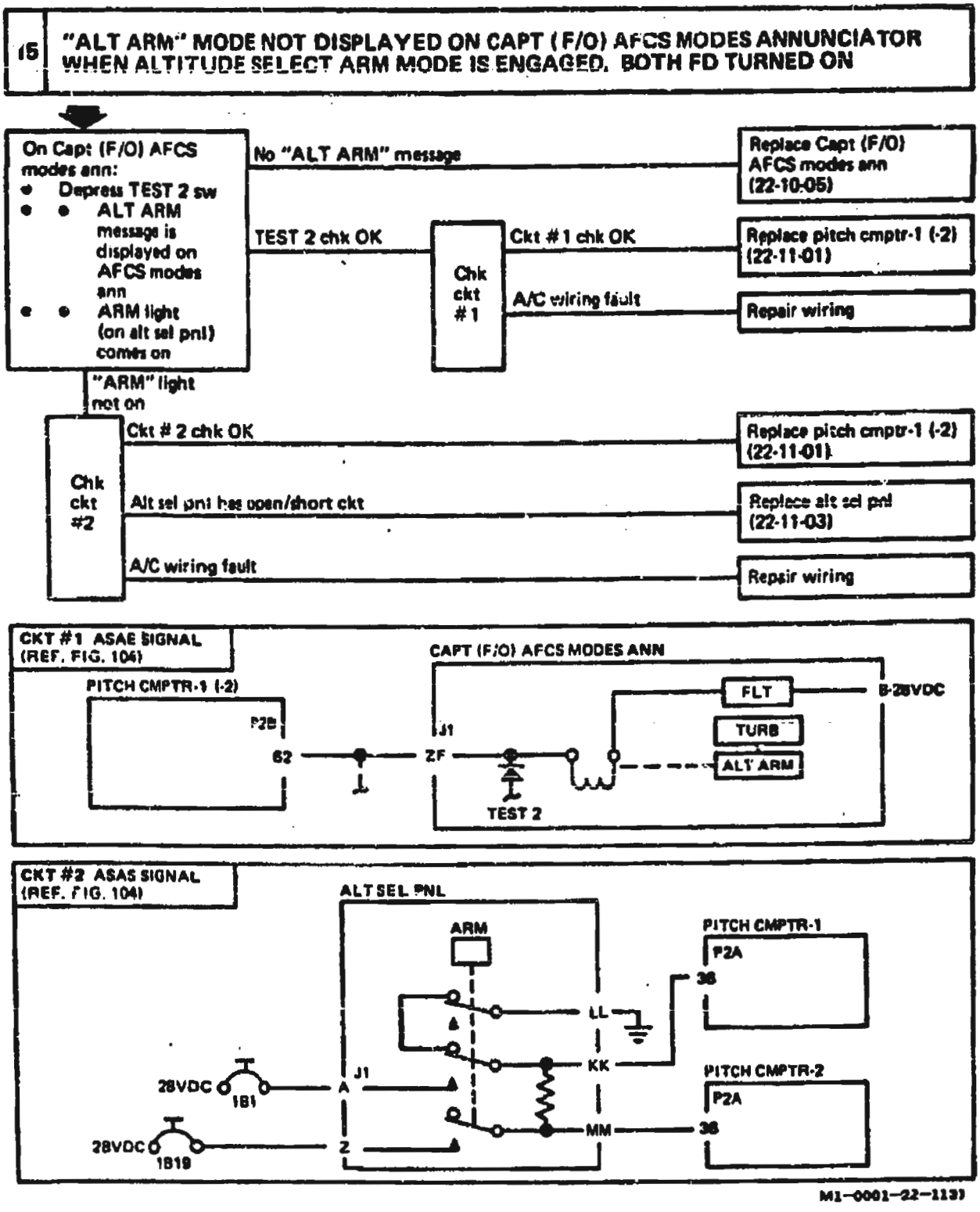
14	SYS DID NOT BEGIN ALTITUDE CAPTURE AND WILL NOT CAPTURE SELECTED ALTITUDE WITH AIR DATA SOURCE KNOB IN NORM (STBY) POSITION. BOTH ADIs DID NOT INDICATE LEVEL OFF AT SELECTED ALTITUDE



M1-0002-22-1129

R FD Altitude Select Mode Faults
R Figure 104 (Sheet 4)

R EFFECTIVITY: ALL



M1-0001-22-113)

R FD Altitude Select Mode Faults
R Figure 104 (Sheet 5)

R EFFECTIVITY: ALL
R
001B

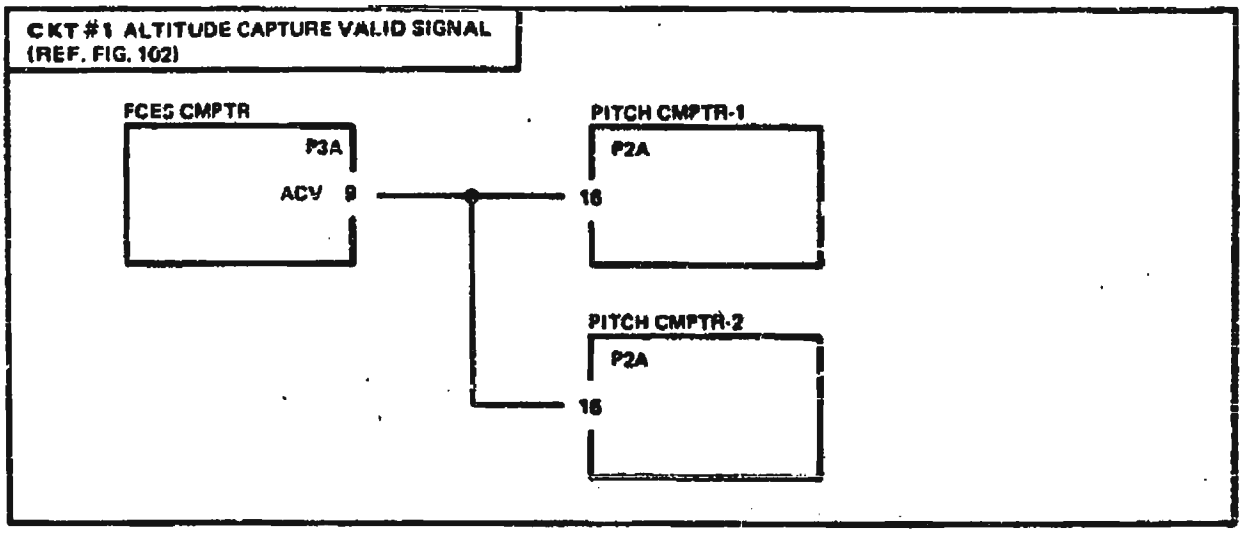
16	ALTITUDE SELECT "ARM" LIGHT DOES NOT COME ON WHEN DEPRESSED WITH AIR DATA SOURCE KNOB IN NORM (STBY) POSITION. SYSTEM OK IN OTHER KNOB POSITION

→ Replace FCES cmptr (22-17-01)

17	ALTITUDE SELECT "ARM" LIGHT DOES NOT COME ON WHEN DEPRESSED WITH AIR DATA SOURCE KNOB IN BOTH NORM AND STBY POSITIONS

Chk ckt #1

- Ckt #1 chk OK → Replace FCES cmptr (22-17-01)
- A/C wiring fault → Repair wiring



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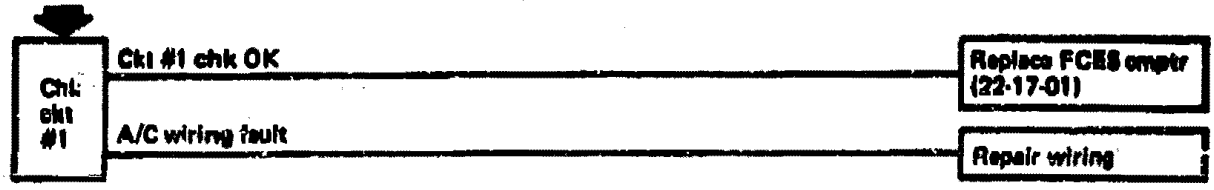
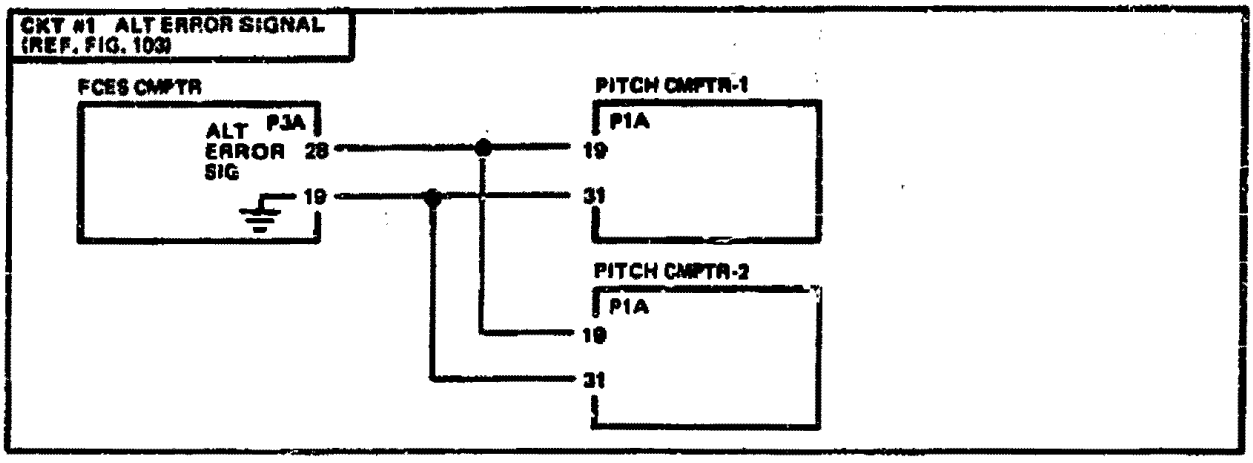
R FD Altitude Select Mode Faults
R Figure 104 (Sheet 6)

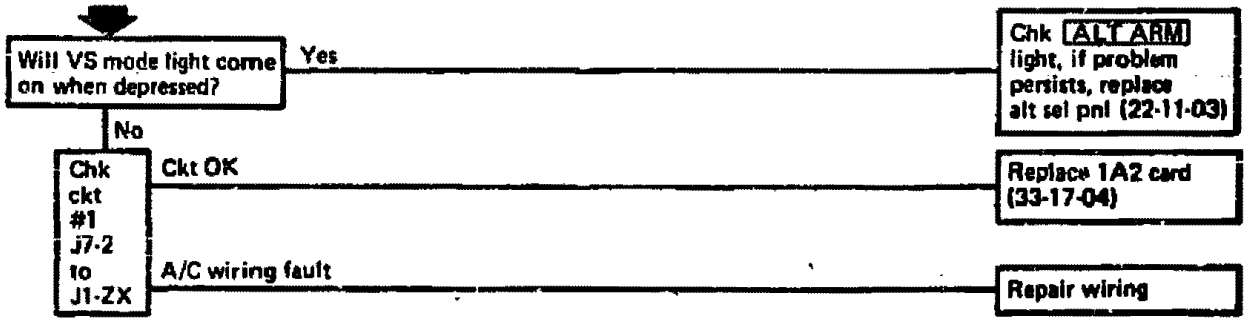
R EFFECTIVITY: ALL
R
0018

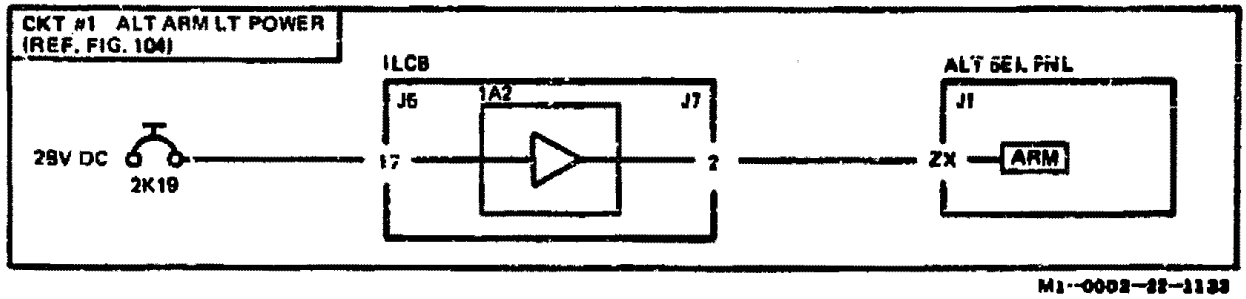
18 ALTITUDE SELECT "ARM" LIGHT COMES ON MOMENTARILY, THEN "ALT" HOLD LIGHT COMES ON





19 ARM MODE LIGHT DOES NOT COME ON WHEN DEPRESSED. ALT ARM MESSAGES IN-VIEW


Will VS mode light come on when depressed?
Yes
Chk ALT ARM light, if problem persists, replace alt sel pnl (22-11-03)
No
Chk ckt #1 J7-2 to J1-ZX
Ckt OK
Replace 1A2 card (33-17-04)
A/C wiring fault
Repair wiring



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R FD Altitude Select Mode Faults
R Figure 104 (Sheet 7)

R EFFECTIVITY: ALL

R
001B

20	ALT ARM MESSAGE DROPS OUT BEFORE CAPTURE IN NORM OR STBY

- Replace FCES cmptr (22-17-01).
- If fault persists replace elt act pnl (22-11-03)

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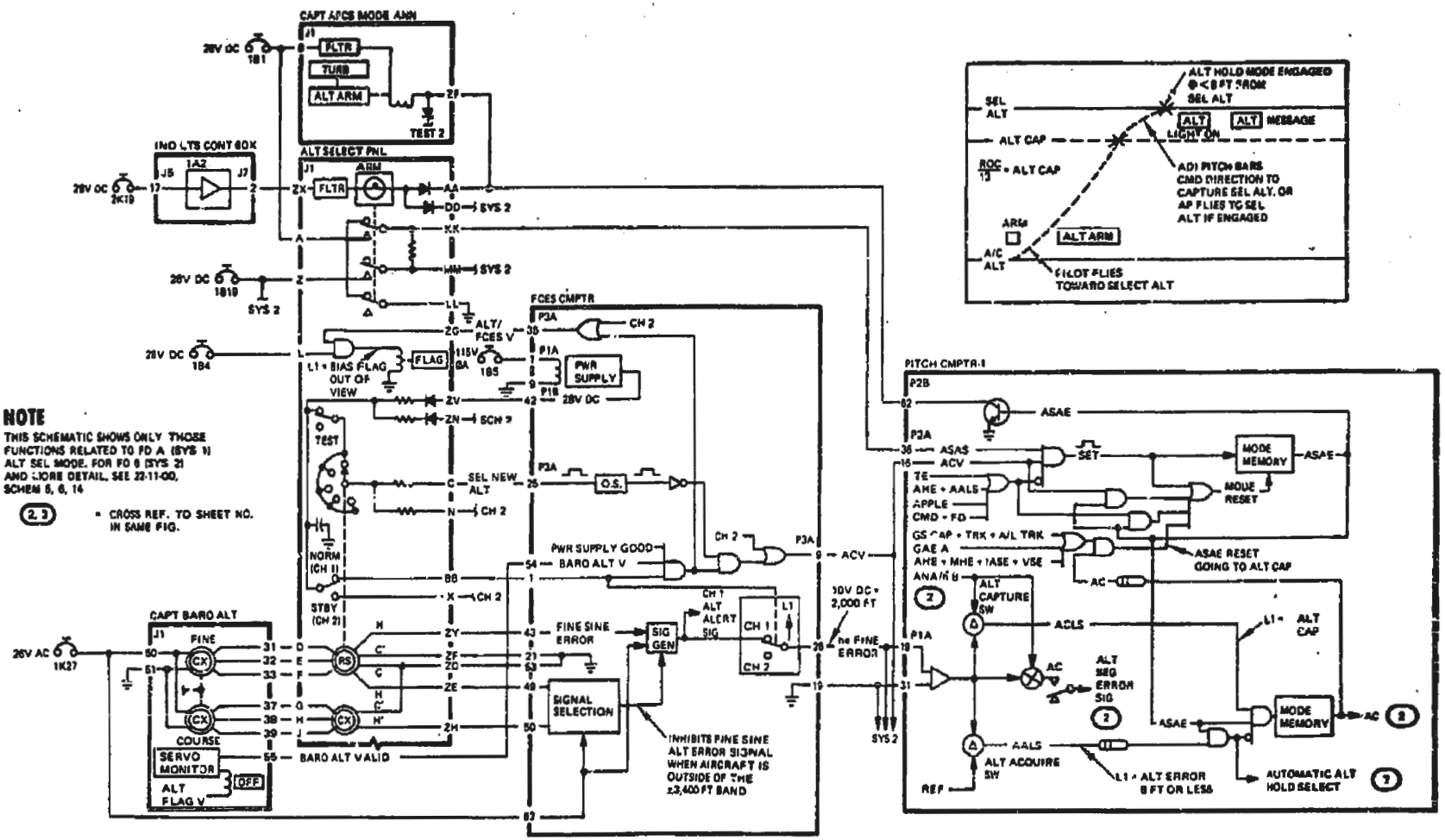
R FD Altitude Select Mode Faults
R Figure 104 (Sheet 8)

EFFECTIVITY: ALL

001B



NOTE

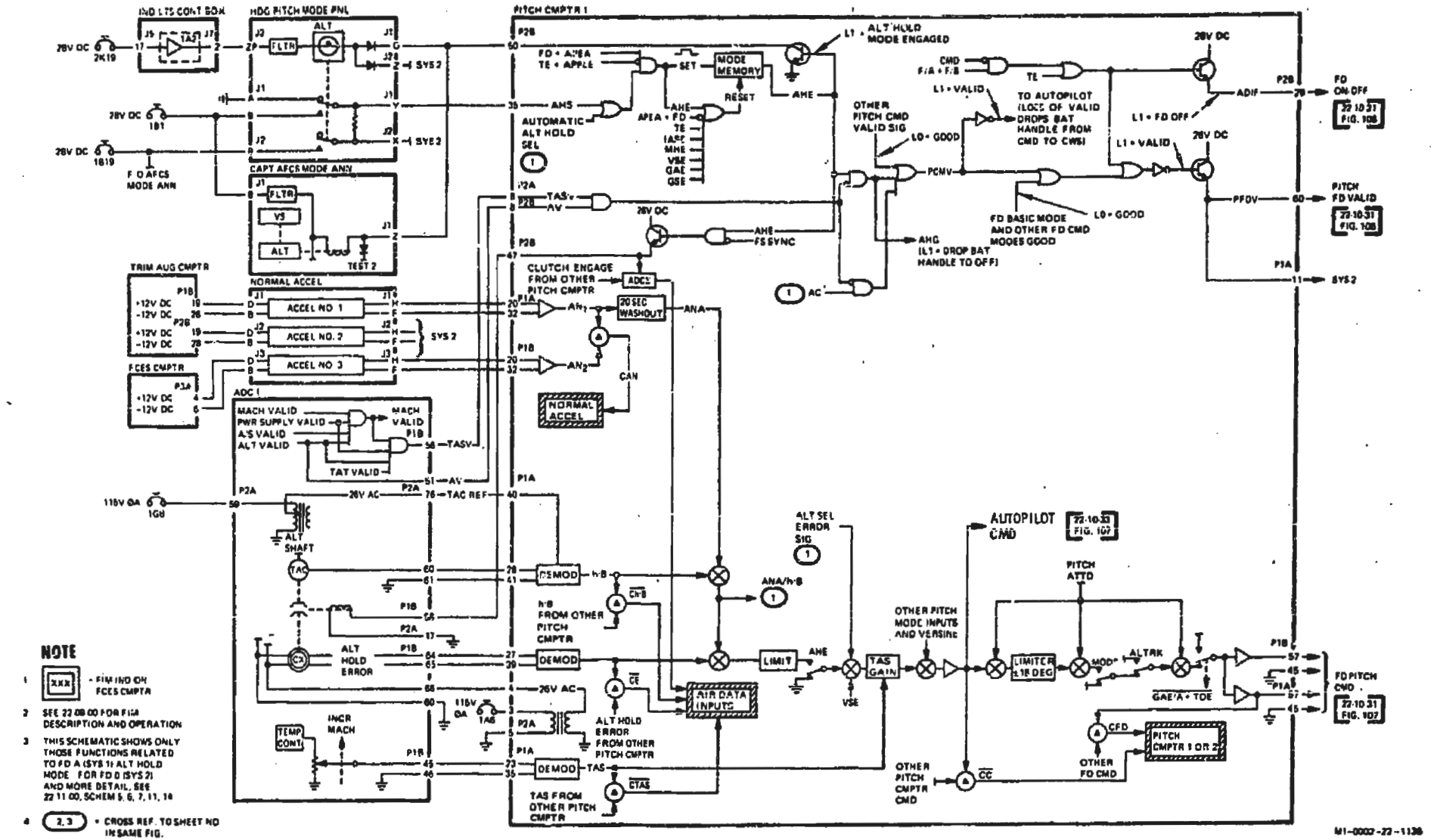
1. THIS SCHEMATIC SHOWS ONLY THOSE FUNCTIONS RELATED TO FD A (SYS 1) ALT SEL MODE. FOR FD B (SYS 2) AND MORE DETAIL, SEE 22-11-00, SCHEM 5, 6, 14
2. (2, 3) = CROSS REF. TO SHEET NO. IN SAME FIG.

M1-0002-22-1134

R Altitude Select Mode Simplified Schematic
R Figure 105 (Sheet 1)

EFFECTIVITY: ALL

001B


IND LTS CONT BOX
HDG PITCH MODE PNL
PITCH CMPTR 1
TRIM AUG CMPTR
NORMAL ACCEL
ACCEL NO 1
ACCEL NO 2
ACCEL NO 3
FCES CMPTR
ADC 1
CAPT AFCS MODE ANN
F O AFCS MODE ANN
MODE MEMORY
AUTOMATIC ALT HOLD SEL
OTHER PITCH CMD VALID SIG
TO AUTOPILOT (LOSS OF VALID DROPS BAT HANDLE FROM CMD TO CWS)
FD BASIC MODE AND OTHER FD CMD MODES GOOD
CLUTCH ENGAGE FROM OTHER PITCH CMPTR
20 SEC WASHOUT
NORMAL ACCEL
ALT SEL ERROR SIG
AUTOPILOT CMD
PITCH ATTD
OTHER PITCH MODE INPUTS AND VERSINE
LIMITER ±18 DEG
ALT HOLD ERROR
AIR DATA INPUTS
TAS GAIN
ALT HOLD ERROR FROM OTHER PITCH CMPTR
TAS FROM OTHER PITCH CMPTR
OTHER PITCH CMPTR CMD
OTHER FD CMD
PITCH CMPTR 1 OR 2
FD ON OFF
PITCH FD VALID
FD PITCH CMD
SYS 2
NOTE
1 XXX - FUNCTION ON FCES CMPTR
2 SEE 22 00 00 FOR FIG DESCRIPTION AND OPERATION
3 THIS SCHEMATIC SHOWS ONLY THOSE FUNCTIONS RELATED TO FD A (SYS 1) ALT HOLD MODE FOR FD B (SYS 2) AND MORE DETAIL, SEE 22 11 00, SCHEM 5, 6, 7, 11, 14
4 2, 3 - CROSS REF. TO SHEET NO IN SAME FIG.

M1-0002-22-1138

R FD Altitude Select Mode Simplified Schematic
R Figure 105 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

FD ALTITUDE SELECT MODE - ADJUSTMENT AND TEST

1. General

The fault detection test procedure in Paragraph 3 is used in conjunction with the fault isolation procedure in Paragraph 4. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 4 for appropriate fault isolation.

2. Referenced Procedures

	22-12-00	APFDS Modes of Operation - Maintenance Practices
	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	Flight Director Basic Mode - Fault Isolation
	22-11-33	FD Altitude Hold Mode - Fault Isolation

3. Fault Detection Test

A. Preliminary Procedures

R R (1) Turn on APFDS as described in 22-12-00, Maintenance Practices.

B. FD Altitude Select Mode Test

(1) On APFDS ENGAGE panel, set both FD switches to ON.

RESULT:

R Both ADI command bars come in view and are level.

Both ADI FD flags are out of view.

(2) On ALT SELECT panel, set NORM-STBY switch to STBY. Verify that fault flag in altitude select window is out of view.

(3) On ALT SELECT panel, set NORM-STBY switch to NORM, ALTITUDE SELECT knob to an altitude 1,000 feet above ambient altitude, and depress ARM switchlight to on. Verify that fault flag is out of view in altitude select window.

RESULT:

On both AFCS MODES annunciators, ALT ARM messages are displayed.

(4) On ALT SELECT panel, rapidly rotate ALTITUDE SELECT knob to an altitude 100 feet above ambient altitude.

RESULT:

ARM light goes out.

(5) Depress ARM switchlight to on. Hold TEST switch in and slowly rotate ALTITUDE SELECT knob until ARM light goes off.

RESULT:

On HEADING/PITCH MODE panel, ALT light comes on.

On both AFCS MODES annunciators, ALT messages are displayed.

On both ADIs, FD flags are out of view, and command bars are centered.

(6) Set ALTITUDE SELECT knob to an altitude 1,000 feet above ambient altitude, and depress ARM switchlight to on.

RESULT:

On both AFCS MODES annunciators, ALT ARM messages are displayed.

(7) On CB1, open FCES AC & LAOA (B5) circuit breaker. On FE/SQ overhead circuit breaker panel CB2, open R AOA (F1) circuit breaker.

RESULT:

On ALTITUDE SELECT panel, ARM light goes out, and fault flag is displayed in altitude select window.

On both AFCS MODES panels, ALT ARM message goes off.

(8) Close B5 (CB1) and F1 (CB2) circuit breakers.

(9) Depress ALT switchlight to off.

RESULT:

R On both AFCS MODES annunciators, ALT messages are removed.

(10) Set ALTITUDE SELECT knob to 30,000 feet.

(11) Depress ARM switchlight to on.

(12) If not connected, connect air data tester to CADC systems No. 1 and 2. On each tester, establish an airspeed of 130 knots at ambient altitude (Ref. 34-13-00).

(13) On both air data testers, increase airspeed to 250 knots and altitude to 30,000 feet.

RESULT:

On ALTITUDE SELECT panel, ARM light goes out.

ALT switchlight comes on.

On both AFCS MODES annunciators, ALT messages are displayed.

The above indications occur at selected altitude.

(14) On each air data tester, establish zero airspeed and ambient altitude.

(15) Set both FD switches to OFF.

4. Fault Isolation

A. General

Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 4B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 4B.

Since no fault isolation system can cover every potential fault, references to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

FD Altitude Select Mode Fault Isolation Summary
Table 501

	TEST REF.	FAULT	FAULT NO.
	3B(1)	ADI fault indication	(1)
	3B(2)	Fault flag displayed on ALT SELECT panel (STBY)	(2)
	3B(3)-1	Fault flag displayed on ALT SELECT panel (NORM)	(3)
R	3B(3)-2	ARM switchlight on ALT SELECT panel not on	(4)
	3B(3)-3	No ALT ARM display on Capt AFCS MODES annunciator	(5)
	3B(3)-4	No ALT ARM display on F/O AFCS MODES annunciator	(6)
R R	3B(4)	ARM switchlight on ALT SELECT panel remains on	(7)
R	3B(5)-1	ARM switchlight is on	(8)
R	3B(5)-2	ALT switchlight not on	(9)
	3B(5)-3	No ALT message displayed on Capt AFCS MODES annunciator	(10)
	3B(5)-4	No ALT message displayed on F/O AFCS MODES annunciator	(11)

FD Altitude Select Mode Fault Isolation Summary (Cont)
Table 501

	TEST REF.	FAULT	FAULT NO.
	3B(5)-5	ADI fault indication	(12)
R	3B(7)-1	ARM switchlight remains on	(13)
	3B(7)-2	Fault flag not displayed on ALT SELECT panel	(14)
	3B(9)	Altitude hold mode not disengaged	(15)
	3B(13)-1	Altitude select mode not disengaged	(16)
	3B(13)-2	Altitude hold mode not engaged	(17)

Schematics for Fault Isolation of FD Altitude Select Mode Problem
Table 502

TITLE	LOCATION
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
Altitude Arm Capture, and Hold Mode Engage Logic Schematic	22-11-00, Schem 14
Altitude Alert Schematic	22-17-00, Schem 4

B. FD Altitude Select Mode Faults

(1) Fault: ADI fault indication

(a) Perform Steps (1) and (2) of FD basic mode test procedure (Ref. 22-10-31).

---

(2) Fault: On ALT SELECT panel, Fault flag displayed (STBY)

(a) On F/O ALT indicator, is OFF flag displayed?

Yes: Check air data system No. 2 for fault (Ref. 34-14-00).

No: Go to Step (b).

(b) On ALT SELECT panel, set NORM-STBY switch to NORM. On ALT SELECT panel, is fault flag still displayed?

Yes: Replace ALT SELECT panel (Ref. 22-11-03).
No: Replace FCES computer (Ref. 22-17-01).

---

(3) Fault: On ALT SELECT panel, fault flag displayed (NORM)

(a) On Capt ALT indicator, is OFF flag displayed?

Yes: Check air data system No. 1 for fault (Ref. 34-14-00).

No: Go to Step (b).

R (b) On Capt INSTRUMENT SOURCE SELECT panel, depress ALT switchlight to turn on ALTN legend. On ALT SELECT panel, is fault flag still displayed?

Yes: Check Capt ALT indicator for fault (Ref. 34-14-00).

No: Replace FCES computer (Ref. 22-17-01).

R (4) Fault: On ALT SELECT panel, ARM switchlight not on

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ARM switchlight fault?

Yes: Go to Step (b).

No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

R (b) Is ALT switchlight on?

Yes: Go to Step (c).

No: Replace ALT SELECT panel (Ref. 22-11-03).

(c) On ALT SELECT panel, set NORM-STBY switch to STBY. Depress ALT switchlight to off. On ALT SELECT panel, depress ARM switchlight. Does ARM
R switchlight come on?

Yes: Replace FCES computer (Ref. 22-17-01). If problem persists, replace ALT SELECT panel (Ref. 22-11-03).

No: Go to Step (d).

R (d) Is ALT switchlight on?

Yes: Replace FCES computer (Ref. 22-17-01). If problem persists, replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace ALT SELECT panel (Ref. 22-11-03).

---

(5) Fault: On Capt AFCS MODES annunciator, no ALT ARM display

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ALT ARM MESSAGE FAULT?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace ALT SELECT panel (Ref. 22-11-03). If problem persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

(6) Fault: On F/O AFCS MODES annunciator, no ALT ARM display

(a) Can mode annunciation press-to-test procedure (Ref; 22-02-01) be performed with no indicated ALT ARM message fault?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace ALT SELECT panel (Ref. 22-11-03). If problem persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

R (7) Fault: On ALT SELECT PANEL, ARM switchlight remains on

(a) Does altitude alert aural warning sound?

Yes: Check FCES altitude alert functions for fault (Ref. 22-17-00).

No: Go to Step (b).

(b) On both AFCS MODES annunciators, is ALT ARM message displayed?

Yes: Replace FCES computer (Ref. 22-17-01).

No: Go to Step (c).

(c) On either AFCS MODES annunciator, is ALT ARM message displayed?

Yes: Replace associated pitch computer (Ref. 22-11-01).

No: Replace ALT SELECT panel (Ref. 22-11-03).

R (8) Fault: On ALT SELECT panel, ARM switchlight is on

(a) On either AFCS MODES annunciator, is ALT message displayed?

Yes: Go to Step (b).

No: Check FCES computer for fault (Ref. 22-17-00).

(b) On Capt AFCS MODES annunciator, is ALT message displayed?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace pitch computer No. 1 (Ref. 22-11-01).

R (9) Fault: ALT switchlight is not on

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ALT switchlight fault?

Yes: Go to Step (b).

No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

(b) On either AFCS MODES annunciator, is ALT message displayed?

Yes: Replace HEADING/PITCH MODE panel (Ref. 22-10-03).

No: Check FCES computer for fault (Ref. 22-17-00).

---

(10) Fault: On Capt AFCS MODES annunciator, no ALT message display

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ALT message fault?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

(11) Fault: On F/O AFCS MODES annunciator, no ALT message display

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ALT message fault?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciator fault isolation procedure (Ref. 22-02-01).

(12) Fault: ADI fault indication

(a) Perform FD altitude hold mode fault isolation procedure (Ref. 22-11-33).

R (13) Fault: On ALT SELECT panel, ARM switchlight remains on

(a) On Capt AFCS MODES annunciator, is ALT ARM message displayed?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

(14) Fault: On ALT SELECT panel, fault flag not displayed

(a) Replace ALT SELECT panel (Ref. 22-11-03).

(15) Fault: Altitude hold mode not disengaged

(a) Perform FD altitude hold mode fault isolation procedure (Ref. 22-11-33).

(16) Fault: Altitude select mode not disengaged

R (a) Is ALT switchlight on?

Yes: Repeat Steps (1) through (7) of test procedure in Paragraph 38.

No: Check FCES computer for fault (Ref. 22-17-00).

---

(17) Fault: Altitude hold mode not engaged

(a) Check FCES computer for fault (Ref. 22-17-00).

FD IAS HOLD MODE - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting FD IAS Hold Mode faults are included in this section of the manual. An FD IAS Hold Mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use FD IAS Hold Mode Matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the FD IAS Hold Mode fault isolation diagrams and schematics. Figure 101 and 102 provide component location for FD IAS Hold Mode troubleshooting.

A. General

FD IAS hold mode fault isolation contains two levels of troubleshooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2B) trouble shoots a specific FD IAS hold mode problem. System oriented fault isolation (Ref. 22-11-37, Page 501) tests and troubleshoots FD IAS hold mode problems.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the FD IAS hold mode by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-11-37, Page 501) to isolate problem.

Figure 104 provides diagnostic steps to further isolate the fault. The diagnostic steps are in a flow chart form which

R contains complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the actions are outside the blocks. When using the flow charts, it is assumed that systems are in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

Fault Isolation Diagram and Schematic List
Table 101

Figure	Title
101	Component Location Index
102	Component Locator Diagram
103	FD IAS Hold Mode Fault Matrix
104	FD IAS Hold Mode Faults
105	FD IAS Hold Mode Simplified Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER - AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER - PITCH	2	FESC, CTR RACK/112AB	22-11-01
CONTROL BOX--INDICATOR LIGHTS, CARD 1A2	1	FESC, AFT OF ELEC RACK/112AB	33-17-04
INDICATOR-AFCS MODE ANNUNCIATOR	2	FLT STA/CAPT AND F/O INSTR PNL	22-10-05
PANEL - HEADING/PITCH MODE COMMAND	1	FLT STA/GLARESHIELD	22-10-03
SERVO - STABILIZER AUTOPILOT CONTROL	1	AFTERBODY/316DB	22-11-05
WHEEL - CONTROL	2	FLT STA	27-11-01

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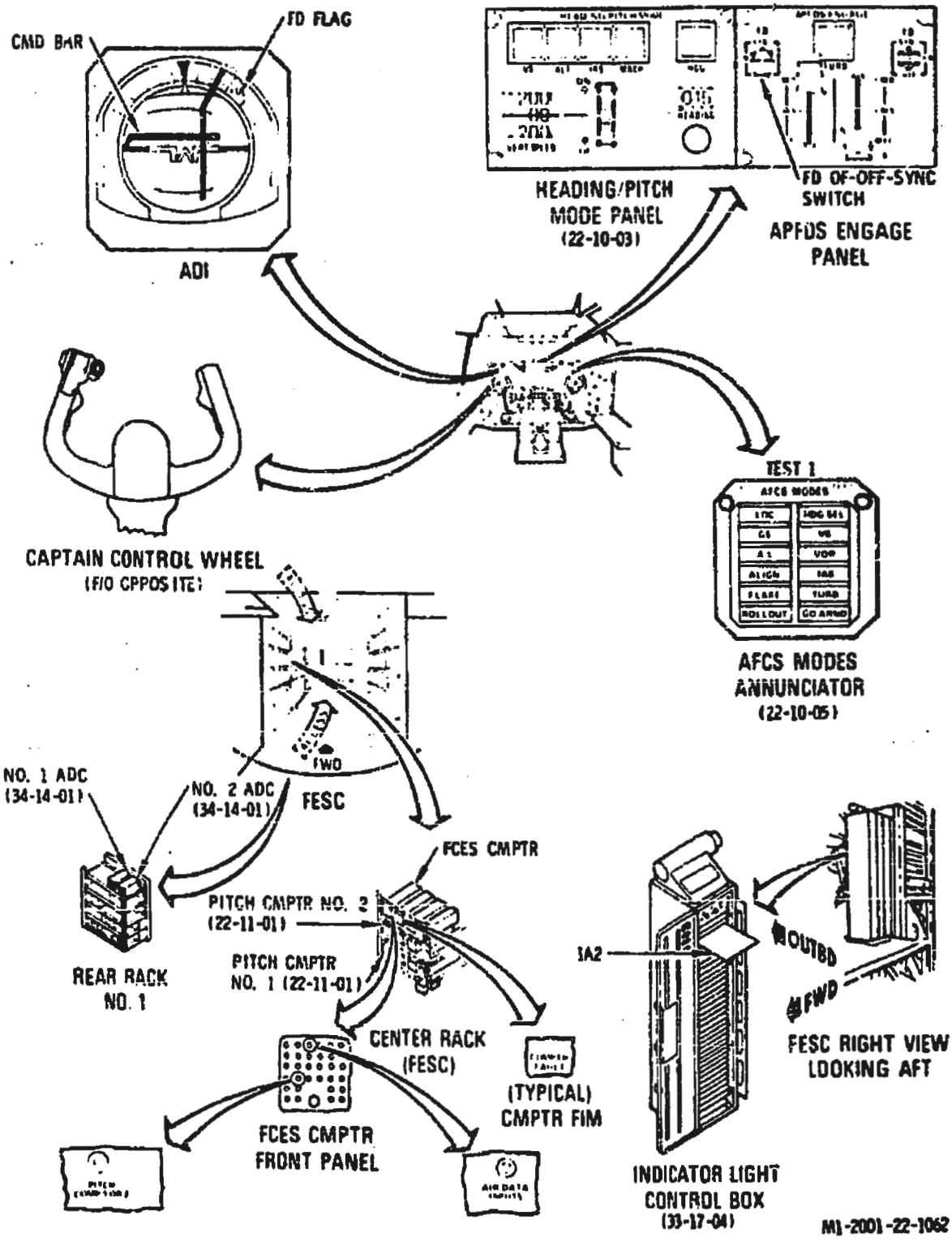
R R Component Location Index
Figure 101

R EFFECTIVITY: ALL



R R Component Locator Diagram
Figure 102

R R EFFECTIVITY: ALL

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FAULTS		FIM			NO FIM			
No.	Problem (Capt or F/O) Capt FIRM Codes With -1 → ⧸ ← F/O FIRM Codes With -2 X ← Use With Both FIRM Codes	Troubleshooting Faulty LRU Check FIM on LRU or on Front Panel of FCES Cmptr ADC	PC	AP SERVO	Continuity Check or Replace CW	HDG/PITCH PNL	MODES ANN	ILCB CARD
"IAS MODE ENGAGED – BOTH FD ON AND BOTH AP OFF" (Ref. Fig. 104)								
1	Capt (F/O) ADI CMD bar does not follow other ADI in pitch when both FD are engaged in "IAS" mode.	1/2	1/2	X	1/2			
2	FD flag in-view, CMD bar out-of-view on Capt (F/O) ADI when both FD are engaged in "IAS" mode. AP (same side) drops from CMD to CWS (CMD DISC) if turned on.	1/2	1/2					
3	"IAS" mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in "IAS" mode. ADI CMD bar (same side) follows other ADI bar in pitch.		1/2				1/2	
4	"IAS" mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in "IAS" mode. ADI CMD bar (same side) does not follow other ADI bar in pitch.		1/2			X		
5	IAS mode light does not come on when depressed.							1A2

Abbreviations		Remove and Install Ref. Chapt.	Page
ADC	Air Data Computer	34-14-01	401
AP SERVO	Stabilizer AP Control Servo	22-11-05	401
CW	Control Wheel	27-11-01	401
HDG/PITCH PNL	Heading/Pitch Mode Panel	22-10-03	401
ILCB CARD	Indicator Lights Control Box Card	33-17-04	401
MODES ANN	AFCS Modes Annunciator	22-10-06	401
PC	Pitch Computer	22-11-01	401

HOW TO USE

1. Find flight squawk in FAULTS column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104

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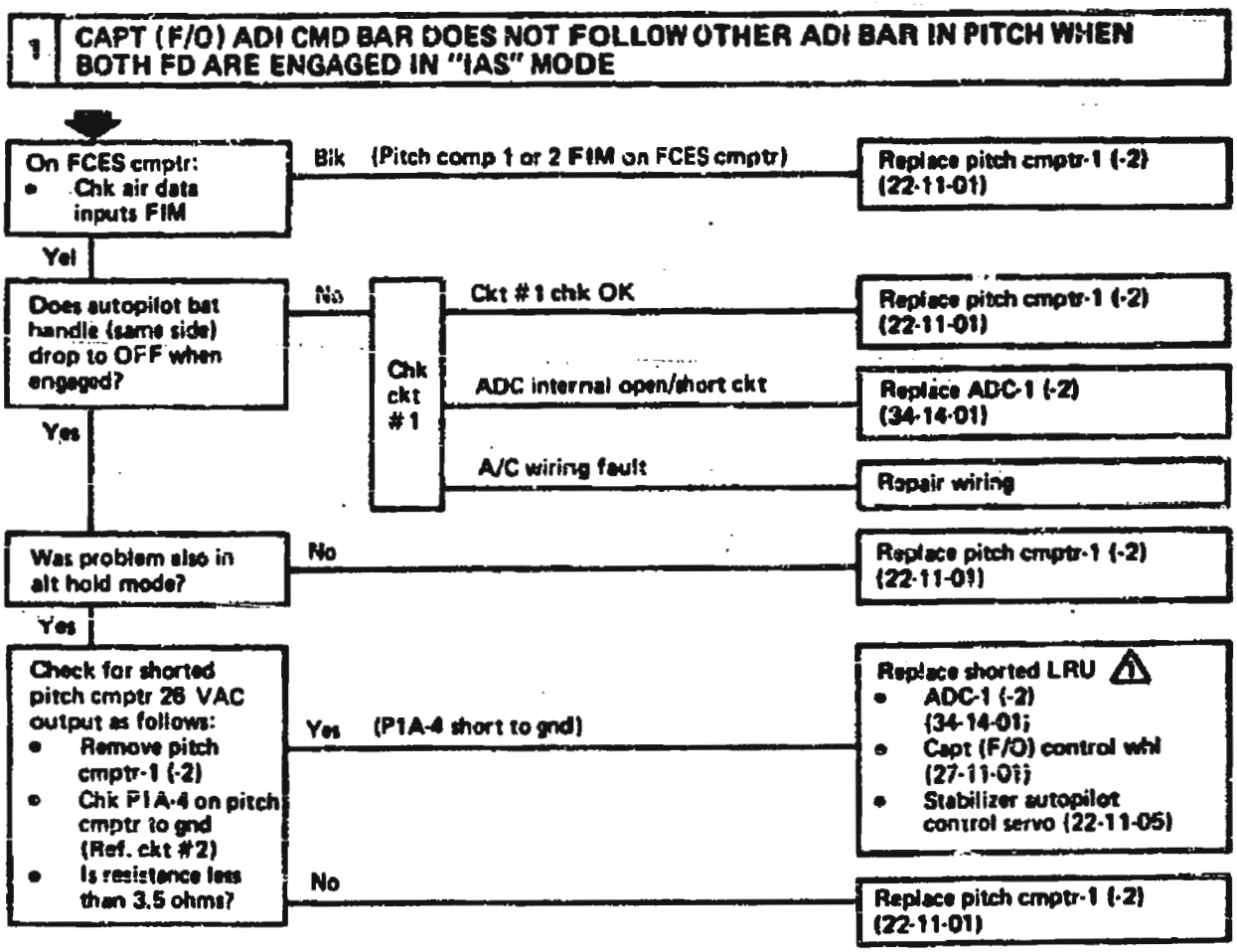
R FD IAS Hold Mode Fault Matrix
R Figure 103

R EFFECTIVITY: ALL

001B


1
CAPT (F/O) ADI CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN PITCH WHEN BOTH FD ARE ENGAGED IN "IAS" MODE
On FCES cmptr:
• Chk air data inputs FIM
Blk (Pitch comp 1 or 2 FIM on FCES cmptr)
Replace pitch cmptr-1 (-2) (22-11-01)
Yes
Does autopilot bat handle (same side) drop to OFF when engaged?
No
Chk ckt #1
Ckt #1 chk OK
Replace pitch cmptr-1 (-2) (22-11-01)
ADC internal open/short ckt
Replace ADC-1 (-2) (34-14-01)
A/C wiring fault
Repair wiring
Yes
Was problem also in alt hold mode?
No
Replace pitch cmptr-1 (-2) (22-11-01)
Yes
Check for shorted pitch cmptr 26 VAC output as follows:
• Remove pitch cmptr-1 (-2)
• Chk P1A-4 on pitch cmptr to gnd (Ref. ckt #2)
• Is resistance less than 3.5 ohms?
Yes (P1A-4 short to gnd)
Replace shorted LRU ⚠
• ADC-1 (-2) (34-14-01)
• Capt (F/O) control whl (27-11-01)
• Stabilizer autopilot control servo (22-11-05)
No
Replace pitch cmptr-1 (-2) (22-11-01)

NOTE

⚠ Replace pitch cmptr-1 (-2) after faulted (shorted) LRU is replaced

2 For FIRM codes followed by -2, use LRU in parenthesis ( )

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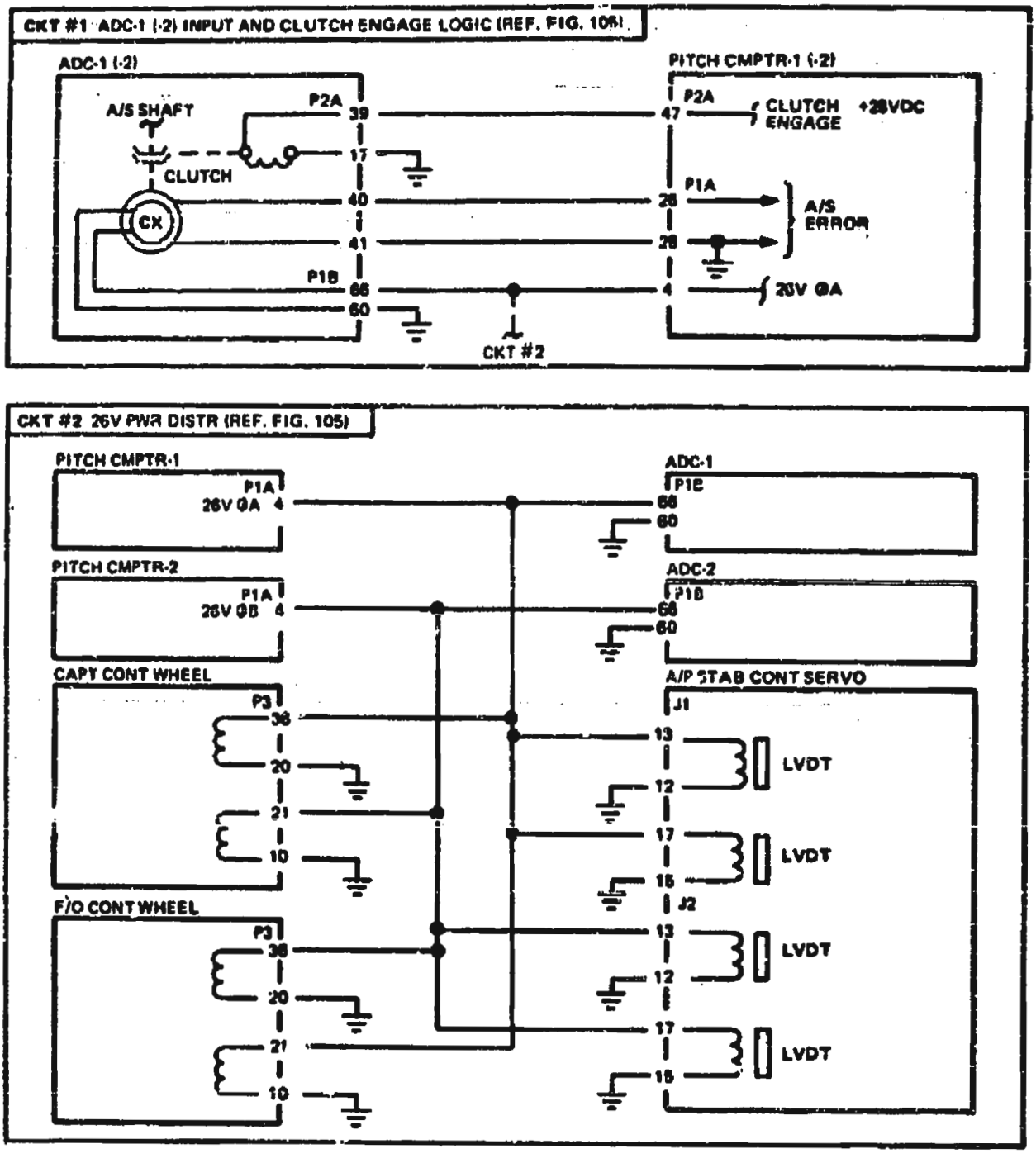
R FD IAS Hold Mode Faults
R Figure 104 (Sheet 1)

R EFFECTIVITY: ALL
R
0018

1 CONTINUED



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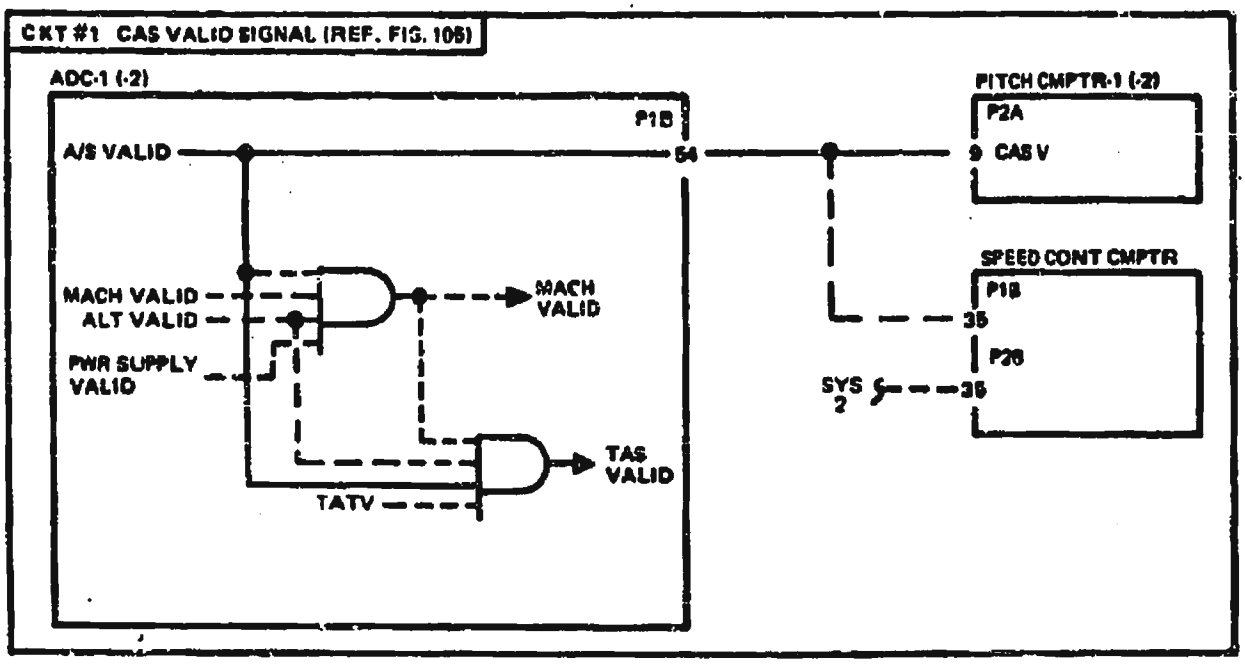
R FD IAS Hold Mode Faults
R Figure 104 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

2	FD FLAG IN-VIEW, CMD BAR OUT-OF-VIEW ON CAPT (F/O) ADI WHEN BOTH FD ARE ENGAGED IN "IAS" MODE. AP (SAME SIDE) DROPS FROM CMD TO CWS (CMD DISC) IF TURNED ON.

Chk ckt #1
Ckt #1 chk OK
A/C wiring fault
• Replace pitch cmptr-1 (-2) (22-11-01)
• If problem persists, replace ADC-1 (-2) (34-14-01)
Repair wiring



NOTE
For FIRM codes followed by -2 use LRU in parenthesis ( )

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R FD IAS Hold Mode Faults
R Figure 104 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

3 "IAS" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "IAS" MODE. CMD BAR (SAME SIDE) FOLLOWS OTHER CMD BAR IN PITCH

Mode ann fault

On Capt (F/O) AFCS modes ann:
- Depress TEST 1 sw.
- - IAS message is displayed on AFCS modes ann.
- - IAS light (on hdg/pitch mode pnl) comes on

NO "IAS" message → Replace Capt (F/O) AFCS modes ann (22-10-05)

No "IAS" light → Ckt ckt #1
- A/C wiring fault → Repair wiring
- AFCS modes ann has inter open ckt → Replace Capt (F/O) AFCS modes ann (22-10-05)

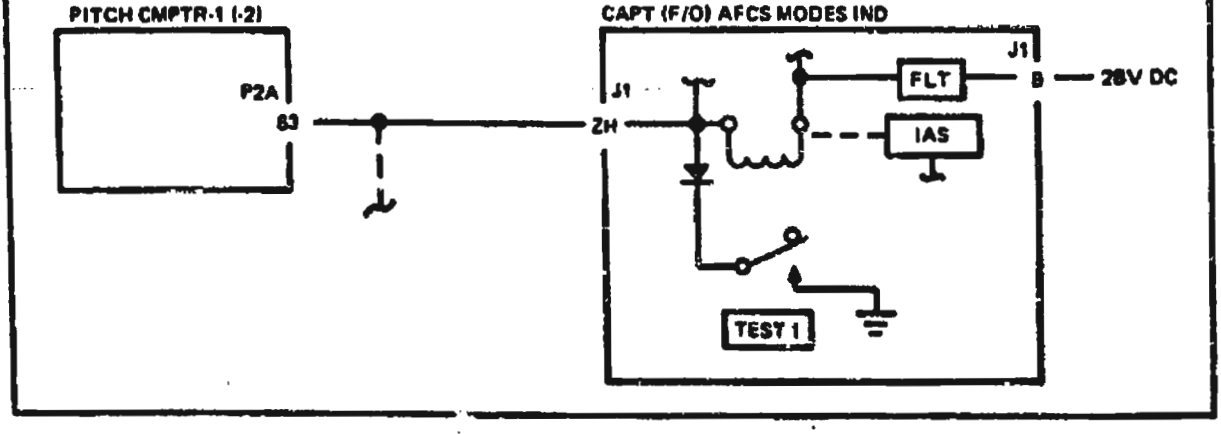
TEST 1 OK

Swap pitch cmptr-1 and -2 → Trouble follows pitch cmptr → Replace pitch cmptr-1 (-2) (22-11-01)

A/C wiring fault → Repair wiring P2A-83 to J1-2H (Ref. Ckt #1)

NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( ).

CKT #1 IAS MODE ANN (REF. FIG. 105)



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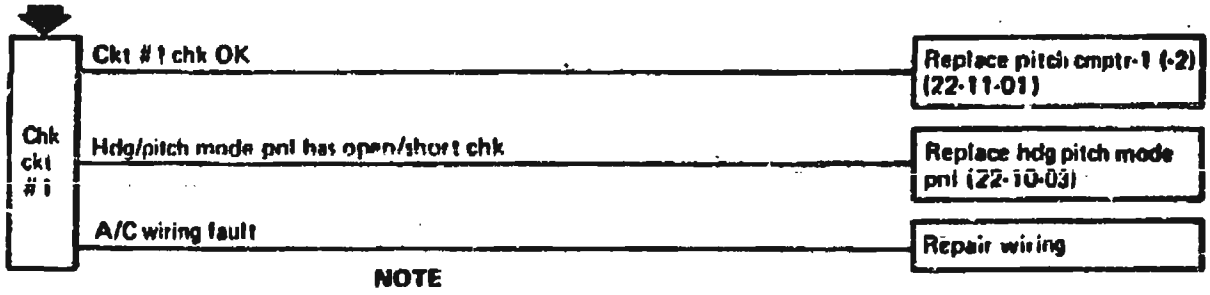
FD IAS Hold Mode Faults
Figure 104 (Sheet 4)

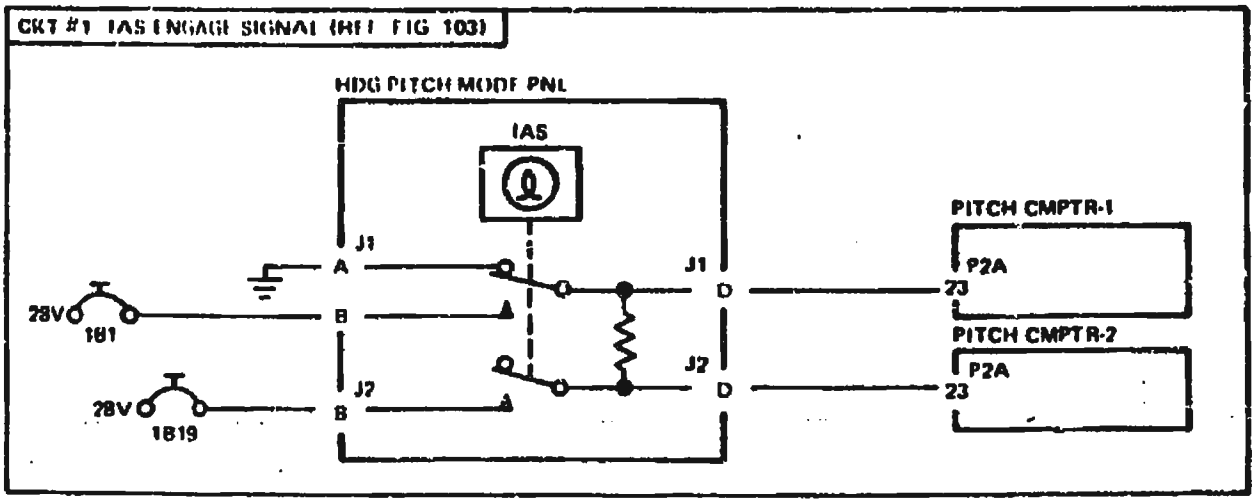
EFFECTIVITY: ALL

4	"IAS" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "IAS" MODE. CMD BAR (SAME SIDE) DOES NOT FOLLOW OTHER CMD BAR IN PITCH.


Chk ckt # 1
Ckt # 1 chk OK
Replace pitch cmptr-1 (-2) (22-11-01)
Hdg/pitch mode pnl has open/short chk
Replace hdg pitch mode pnl (22-10-03)
A/C wiring fault
Repair wiring

NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( ).



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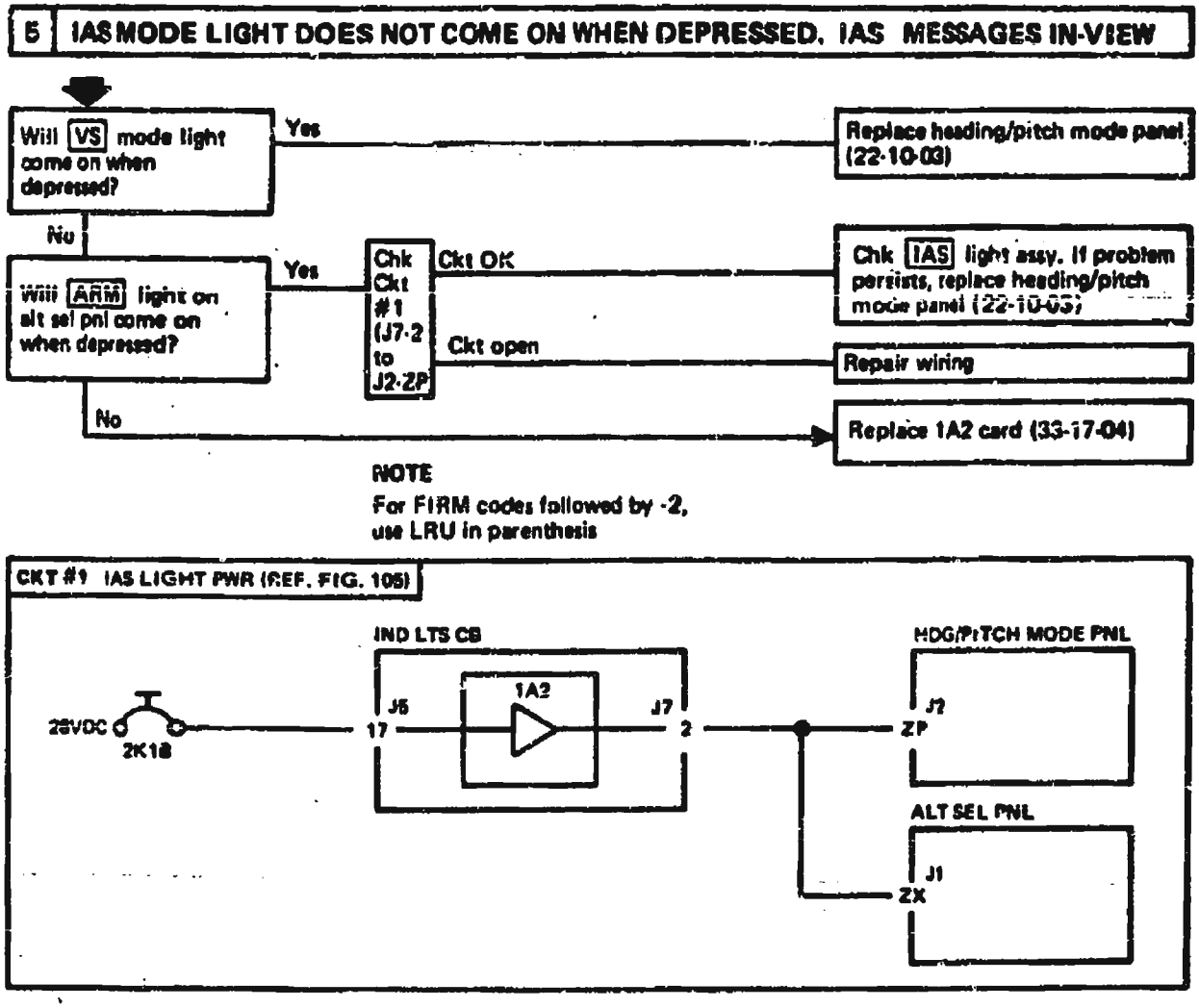
R FD IAS Hold Mode Faults
R Figure 104 (Sheet 5)

R EFFECTIVITY: ALL

R
001B



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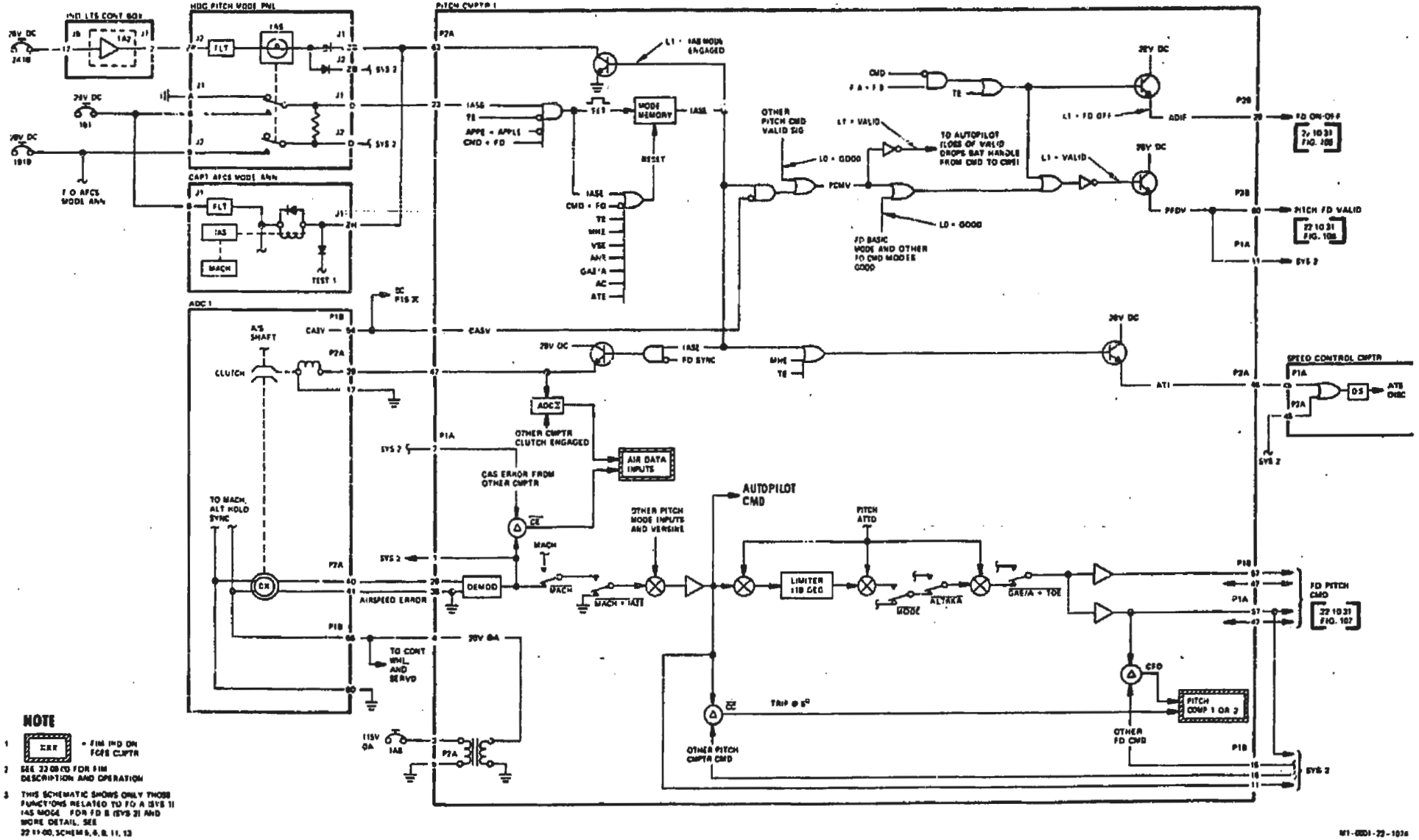
FD IAS Hold Mode Faults
Figure 104 (Sheet 6)

EFFECTIVITY: ALL


HDG PITCH MODE PNL
PITCH CMPTR 1
CAPT AFCS MODE ANN
ADC 1
MACH
TEST 1
MODE MEMORY
RESET
OTHER PITCH CMD VALID SIG
TO AUTOPILOT (LOSS OF VALID DROPS BAT HANDLE FROM CMD TO CWI)
FD BASIC MODE AND OTHER FD CMD MODES GOOD
FD ON-OFF
PITCH FD VALID
A/S SHAFT
CLUTCH
OTHER CMPTR CLUTCH ENGAGED
AIR DATA INPUTS
CAS ERROR FROM OTHER CMPTR
TO MACH, ALT HOLD SYNC
DEMOD
AIRSPEED ERROR
OTHER PITCH MODE INPUTS AND VERSINE
AUTOPILOT CMD
PITCH ATTD
LIMITER ±10 DEG
ALT ARA
GRE/A + TOE
FD PITCH CMD
TO CONT WHL AND SERVO
OTHER PITCH CMPTR CMD
PITCH COMP 1 OR 2
OTHER FD CMD
SPEED CONTROL CMPTR
ATS ENGD
NOTE
SEE 22-00-00 FOR FIM DESCRIPTION AND OPERATION
THIS SCHEMATIC SHOWS ONLY THOSE FUNCTIONS RELATED TO FD A (SYS 1) IAS MODE. FOR FD B (SYS 2) AND MORE DETAIL, SEE 22-11-00, SCHEMS 5, 6, 8, 11, 13

R FD IAS Hold Mode Simplified Schematic
R Figure 105

R EFFECTIVITY: ALL
R
0016

R FD IAS HOLD MODE - ADJUSTMENT AND TEST

R 1. General

R The fault detection test procedure in Paragraph 4 is used in
R conjunction with the fault isolation procedure in Paragraph 5.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 5 for appropriate fault isolation.

R 2. Equipment and Materials

R Type MB-1 Pitot/Static Field Tester, Burton 2024B Pitot/Static
R Tester, or equivalent

R 3. Referenced Procedures

R 22-12-00 APFDS Modes of Operation - Maintenance Practices

R 22-02-01 AFCS Lamps and Annunciators - Fault Isolation

R 22-10-31 Flight Director Basic Mode - Fault Isolation

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00, maintenance
R practices.

R B. FD IAS Hold Mode Test

R (1) Set flaps to less than 30 degrees.

R (2) On FCES panel, depress ATS 1 and 2 switchlights to on
R (dark).

R (3) On pilots center console, set all throttle levers to
R mid-position.

R (4) On APFDS ENGAGE panel, set both FD switches to ON.

R RESULT:

R Both ADI command bars come into view and are
R level.

R Both ADI FD flags are out of view.

R EFFECTIVITY: ALL
R
0018

R (5) On HEADING/PITCH MODE panel, depress IAS switchlight to
R on.

R RESULT:

R On both AFCS MODES annunciators, IAS messages are
R displayed.

R On both ADIs, FD flags are out of view, and
R command bars are centered and level.

R (6) Depress IAS switchlight to off.

R RESULT:

R IAS messages are removed.

R (7) If not connected, connect air data testers to CADC
R systems No. 1 and 2. On each tester, establish an
R airspeed of 200 knots (Ref. 34-13-00).

R (8) Depress IAS switchlight to on.

R RESULT:

R Both IAS messages are displayed.

R Both FD flags are out of view, and both command
R bars are centered.

R (9) On both testers, increase airspeed to 220 knots.

R RESULT:

R On both ADIs, command bars command nose up.

R (10) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit
R breaker.

R RESULT:

R On F/O AFCS MODES annunciator, IAS message is
R removed.

R On F/O ADI, FD flag is displayed and command bar
R is biased out of view.

R (11) On THRUST select panel, set IAS control to 220 knots
R and set ATS switch to on (up position).

R RESULT:

R On HEADING/PITCH MODE panel, IAS switchlight goes
R out.

R On Capt AFCS MODES annunciator, IAS message goes
R out of view.

R (12) On HEADING/PITCH MODE panel, depress IAS switchlight to
R on.

R RESULT:

R On Capt AFCS MODES annunciator, IAS message is
R displayed.

R ATS switch drops to OFF.

R On both AFCS WARNING indicators, ATS DISC messages
R are displayed.

R (13) Reset ATS DISC warning by depressing ATS DISC switch on
R outboard throttle lever.

R (14) Set both FD switches to OFF.

R (15) Close A24 circuit breaker.

R (16) Set both FD switches to ON.

R (17) Depress IAS switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, IAS messages are
R displayed.

R (18) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit
R breaker.

R RESULT:

R On Capt AFCS MODES annunciator, IAS message is
R removed.

R On Capt ADI, FD flag is displayed and command bar
R is biased out of view.

R (19) Set ATS switch to on.

R RESULT:

R On HEADING/PITCH MODE panel, IAS switchlight goes
R out.

R On F/O AFCS MODES annunciator, IAS message goes
R out of view.

R (20) Depress IAS switchlight to on.

R RESULT:

R On F/O AFCS MODES annunciator, IAS message is
R displayed.

R ATS switch drops to OFF.

R On both AFCS WARNING indicators, ATS DISC messages
R are displayed.

R Reset ATS DISC warning by depressing ATS DISC
R switch on outboard throttle lever.

R (21) Set both FD switches to OFF.

R (22) Close A6 circuit breaker.

R (23) Set both FD switches to ON.

R (24) Depress IAS switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, IAS messages are
R displayed.

R (25) On CB1, open AIR DATA CMPTR (G8) and (G27) circuit
R breakers.

R RESULT:

R On both ADIs, FD flags are displayed, and command
R bars are biased out of view.

R (26) Close G8 and G27 circuit breakers.

R (27) On each air data tester, establish zero airspeed and
R ambient altitude.

R (28) Set both FD switches to OFF.

R 5. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing
R the Faults Detection Test. It also lists the fault number
R in Paragraph 5B for the appropriate fault isolation
R procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential
R fault, reference to applicable maintenance manual schematics
R are given in Table 502. For fault isolating aircraft
R wiring, use tables on schematics for a listing of applicable
R wiring diagram manual.

R FD IAS Hold Mode Fault Isolation Summary
R Table 501

TEST REF.	FAULT	FAULT NO.
4B(2)	ATS switchlights not dark	(1)
4B(4)	ADI fault indication	(2)
4B(5)-1	IAS switchlight not illuminated	(3)
4B(5)-2	Capt AFCS MODES annunciator IAS message not displayed	(4)
4B(5)-3	F/O AFCS MODES annunciator IAS message not displayed	(5)
4B(5)-4	Capt ADI FD flag displayed	(6)
4B(5)-5	Capt ADI command bar not centered	(7)
4B(5)-6	F/O ADI FD flag displayed	(8)
4B(5)-7	F/O ADI command bar not centered	(9)
4B(6)	IAS switchlight remains illuminated	(10)
4B(9)-1	Capt ADI command bar motion incorrect	(11)
4B(9)-2	F/O ADI command bar motion incorrect	(12)
4B(10)-1	F/O AFCS MODES annunciator IAS message not removed	(13)
4B(10)-2	No F/O ADI fault indication	(14)

FD IAS Hold Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(11)	IAS switchlight remains illuminated	(15)
4B(12)-1	ATS switch does not drop to OFF	(16)
4B(12)-2	ATS DISC message not displayed on Capt AFCS WARNING indicators	(17)
4B(12)-3	ATS DISC message not displayed on F/O AFCS WARNING indicator	(18)
4B(18)-1	IAS message not removed on Capt AFCS MODES annunciator	(19)
4B(18)-2	No Capt ADI fault indication	(20)
4B(19)	IAS switchlight remains illuminated	(21)
4B(20)	ATS switch does not drop to OFF	(22)
4B(25)-1	No Capt ADI fault indication	(23)
4B(25)-2	No F/O ADI fault indication	(24)

Schematics for Fault Isolation of FD IAS Hold Mode Problem
Table 502

TITLE	LOCATION
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
Turbulence, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic Schematic	22-11-00, Schem 13

R B. FD IAS Hold Mode Faults

R (1) Fault: ATS switchlights not dark

R (a) On HEADING/PITCH MODE panel, depress IAS
R switchlight to on. On Capt or F/O ADI, is FD flag
R displayed?

R Yes: Check air data system associated with ADI
R indicating a fault condition (Ref. 34-14-00).

R No: Check speed control system for fault (Ref.
R 22-31-00).

R ---

R (2) Fault: ADI fault indication

R (a) Perform Steps (1) and (2) of FD basic mode test
R procedure (Ref. 22-10-31).

R ---

R (3) Fault: IAS Switchlight not illuminated

R (a) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated IAS
R switchlight fault?

R Yes: Replace HEADING/PITCH MODE panel (Ref.
R 22-10-03).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R ---

R (4) Fault: Capt AFCS MODES annunciator IAS message not
R displayed

R (a) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated IAS
R message fault?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01). If problem persists, replace
R HEADING/PITCH MODE panel (Ref. 22-10-03). If
R problem persists, replace Capt AFCS MODES
R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R ---

R (5) Fault: F/O AFCS MODES annunciator IAS message not displayed

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated IAS message fault:

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (6) Fault: Capt ADI FD flag displayed

(a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (7) Fault: Capt ADI command bar not centered

(a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (8) Fault: F/O ADI FD flag displayed

(a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (9) Fault: F/O ADI command bar not centered

(a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (10) Fault: On HEADING/PITCH MODE panel, IAS switchlight remains illuminated

(a) On Capt AFCS MODES indicator, is IAS message displayed?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01). If problem persists, replace
R HEADING/PITCH MODE panel (Ref. 22-10-03)

R .

R No: Replace pitch computer No. 2 (Ref. 22-11-01).
R If problem persists, replace HEADING/PITCH MODE
R panel (Ref. 22-10-03).

R ---

R (11) Fault: Capt ADI command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Go to Step (b).

R No: Go to Step (c).

R (b) Can vertical speed mode test procedure (Ref.
R 22-11-31) be performed with no indicated faults?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01). If problem persists, check air data
R system No. 1 for fault (Ref. 34-14-00).

R No: Perform vertical speed mode fault isolation
R procedure (Ref. 22-11-31).

R (c) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT
R DIR switchlight to illuminate ALTN legend. Does
R F/O ADI command bar command nose-up?

R Yes: Replace heading coupler accessory unit (Ref.
R 34-22-06). If problem persists, replace Capt ADI
R (Ref. 34-21-07).

R No: Replace pitch computer No. 1 (Ref. 22-11-01).
R If problem persists, replace heading coupler
R accessory unit (Ref. 34-22-06).

R ---

R (12) Fault: F/O ADI command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Go to Step (b).

R No: Go to Step (c).

R (b) Can vertical speed mode test procedure (Ref. 22-11-31) be performed with no indicated faults?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check air data system No. 2 for fault (Ref. 34-14-00).

No: Perform vertical speed mode fault isolation procedure (Ref. 22-11-31).

R (c) On Capt INSTRUMENT SOURCE SELECT panel, depress FLT DIR switchlight to illuminate ALTN legend. Does Capt ADI command bar command nose-up?

Yes: Replace heading coupler accessory unit (Ref. 34-22-06). If problem persists, replace F/O ADI (Ref. 34-21-07).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace heading coupler accessory unit (Ref. 34-22-06).

---

(13) Fault: F/O AFCS MODES annunciator IAS message not removed

(a) Replace pitch computer No. 2 (Ref. 22-11-01).

---

(14) Fault: No F/O ADI fault indication

(a) Replace F/O ADI (Ref. 34-21-07).

---

(15) Fault: On HEADING/PITCH MODE panel, IAS switchlight remains illuminated

(a) On THRUST panel, does ATS switch remain in up position?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

No: Check speed control system for fault (Ref. 22-31-00).

R ---

R (16) Fault: On THRUST select panel, ATS switch does not drop to OFF

R (a) Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

R ---

R (17) Fault: On Capt AFCS WARNING indicator, ATS DISC message not displayed

R (a) Can warning annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ATS DISC message fault?

R Yes: Check speed control system for fault (Ref. 22-31-00). If problem persists, replace Capt AFCS WARNING indicator (Ref. 22-10-06).

R No: Perform warning annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (18) Fault: On F/O AFCS WARNING indicator, ATS DISC message not displayed

R (a) Can warning annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ATS DISC message fault?

R Yes: Check speed control system for fault (Ref. 22-31-00). If problem persists, replace F/O AFCS WARNING indicator (Ref. 22-10-06).

R No: Perform warning annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (19) Fault: On Capt AFCS MODES annunciator, IAS message not removed

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (20) Fault: No Capt ADI fault indication

(a) Replace Capt ADI (Ref. 34-21-07).

---

(21) Fault: On HEADING/PITCH MODE panel, IAS switchlight remains illuminated

(a) On THRUST panel, does ATS switch remain in up position?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

No: Check speed control system for fault (Ref. 22-31-00).

---

(22) Fault: On THRUST select panel, ATS switch does not drop to OFF

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

---

(23) Fault: No Capt ADI fault indication

(a) On CB1, open NO. 1 SYSTEMS/PITCH & ROLL (A6) circuit breaker. On Capt ADI, is FD flag displayed?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace Capt ADI (Ref. 34-21-07).

R (24) Fault: No F/O ADI fault indication

(a) On CB1, open NO. 2 SYSTEMS/PITCH & ROLL (A24) circuit breaker. On F/O ADI, is FD flag displayed?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace F/O ADI (Ref. 34-21-07) .

R # FD MACH HOLD MODE - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting FD Mach Hold Mode faults are included in this section of the manual. FD Mach Hold Mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use FD Mach Hold Mode Fault Matrix.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Identification

R Table 101 is a list of the FD Mach Hold Mode fault isolation diagrams and schematics. Figures 101 and 102 provide component location for FD Mach Hold Mode troubleshooting.

R TABLE 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	FD MACH Hold Mode Fault Matrix
104	FD MACH Hold Mode Faults
105	FD MACH Hold Simplified Schematic

R A. General

R FD MACH hold mode fault isolation contains two levels of troubleshooting: (1) fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2B) trouble

R shoots a specific FD MACH hold mode problem. System oriented
R fault isolation (Ref. 22-11-39, Page 501) tests and trouble
R shoots FD MACH hold mode problems.

R B. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported
R malfunction which is a result of a single failure. Figure 103
R identifies a fault within the FD MACH hold mode by a specific
R fault number. It also identifies and locates the LRUs which can
R cause the problem. For faults not listed in Figure 103, perform
R test (Ref. 22-11-39, Page 501) to isolate problem.

R Figure 104 provides diagnostic steps to further isolate the
R fault. The diagnostic steps are in a flow chart form which
R contains complete fault isolation procedures for each fault.
R Action instructions are contained within the blocks of the flow
R chart while the monitored results of the actions are outside the
R blocks. When using the flow charts, it is assumed that systems
R are in the normal operational mode, all relevant circuit
R breakers have been checked, and all applicable aircraft
R operational procedures have been accomplished.

R Figure 105 is a simplified schematic of the FD MACH hold
R function.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
CONTROL BOX – INDICATOR LIGHTS	1	FESC, AFT OF ELECT RACK/112AB	33-17-04
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05
PANEL – HEADING/PITCH MODE COMMAND	1	FLT STA, GLRSHLD PNL	22-10-03
SERVO – STABILIZER AUTOPILOT CONTROL	1	AFTERBODY/316DB	22-11-05
WHEEL – CONTROL	2	FLT STA	27-11-01

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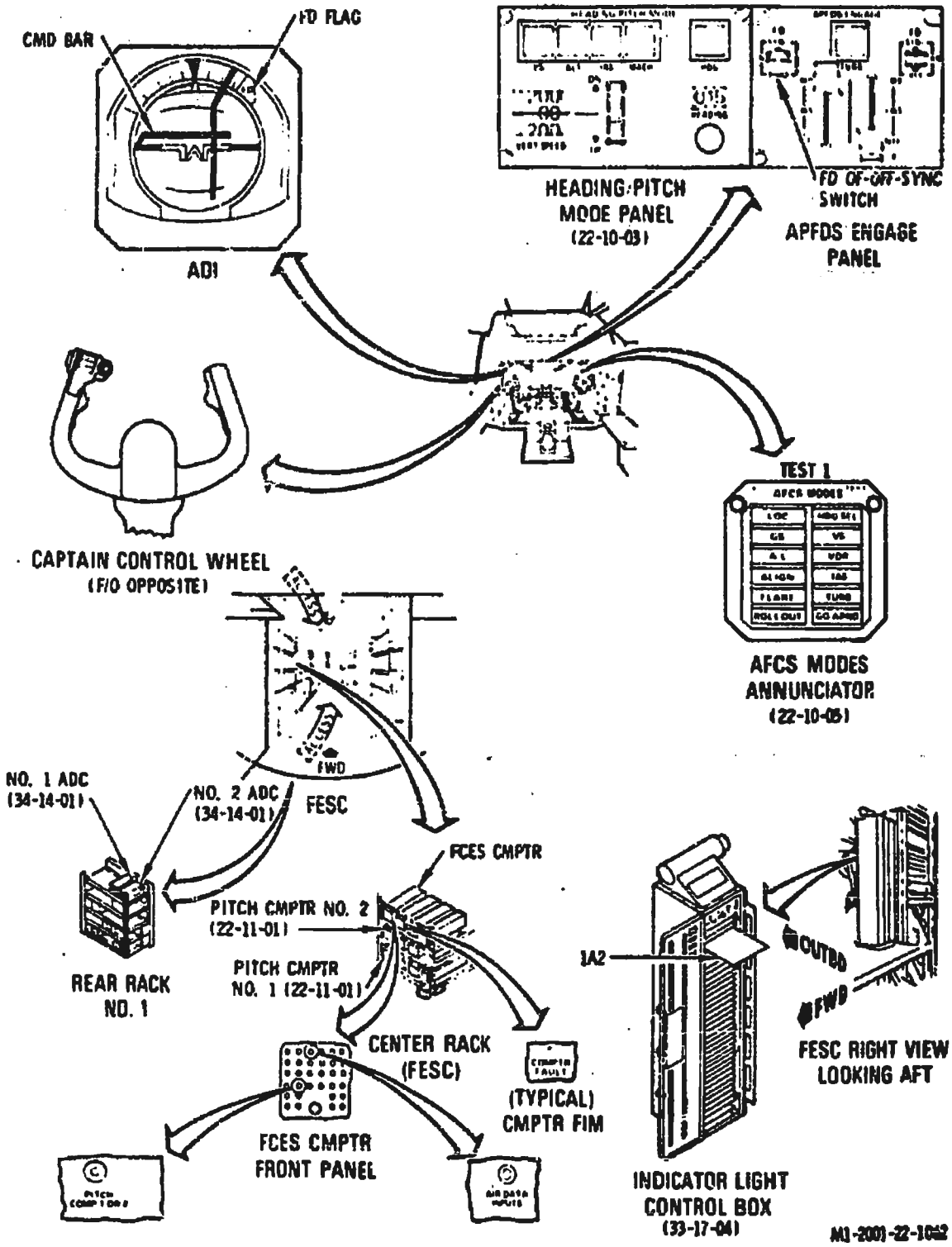
R R Component Location Index
Figure 101

R EFFECTIVITY: ALL
R R
001B



Component Locator Diagram
Figure 102

EFFECTIVITY: ALL

"MACH MODE ENGAGED – BOTH FD ON AND BOTH AP OFF" (Ref. Fig. 104)

No.	FAULTS	FIM: ADC	FIM: PC	FIM: AP SERVO	NO FIM: CW	NO FIM: HDG/PITCH PNL	NO FIM: MODES ANN	NO FIM: ILCB CARD
	Troubleshooting Faulty LRU							
	Problem (Capt or F/O)	Check FIM on LRU or on Front Panel of FCES Cmptr			Continuity Check or Replace			
1	Capt (F/O) ADI CMD bar does not follow other ADI in pitch when both FD are engaged in "MACH" mode	1/2	1/2	X	1/2			
2	FD flag in-view, CMD bar out-of-view on Capt (F/O) ADI when both FD are engaged in "MACH" mode. AP same side drops from CMD to CWS (CMD DISC) if turned on	1/2	1/2					
3	"MACH" mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in "MACH" mode. ADI CMD bar (same side) follows other ADI bar in pitch		1/2				1/2	
4	"MACH" mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in "MACH" mode. ADI CMD bar (same side) does not follow other ADI bar in pitch		1/2			X		
5	MACH mode light does not come on when depressed							1A2

Abbreviations		Remove and Install Ref. Chapt.	Page
ADC	Air Data Computer	34-14-01	401
AP SERVO	Stabilizer AP Control Servo	22-11-05	401
CW	Control Wheel	27-11-01	401
HDG/PITCH PNL	Heading/Pitch Mode Panel	22-10-03	401
ILCB CARD	Indicator Lights Control Box	33-17-04	401
MODES ANN	AFCS Modes Annunciator	22-10-05	401
PC	Pitch Computer	22-11-01	401

HOW TO USE:

1. Find flight squawk in FAULTS column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 or 105

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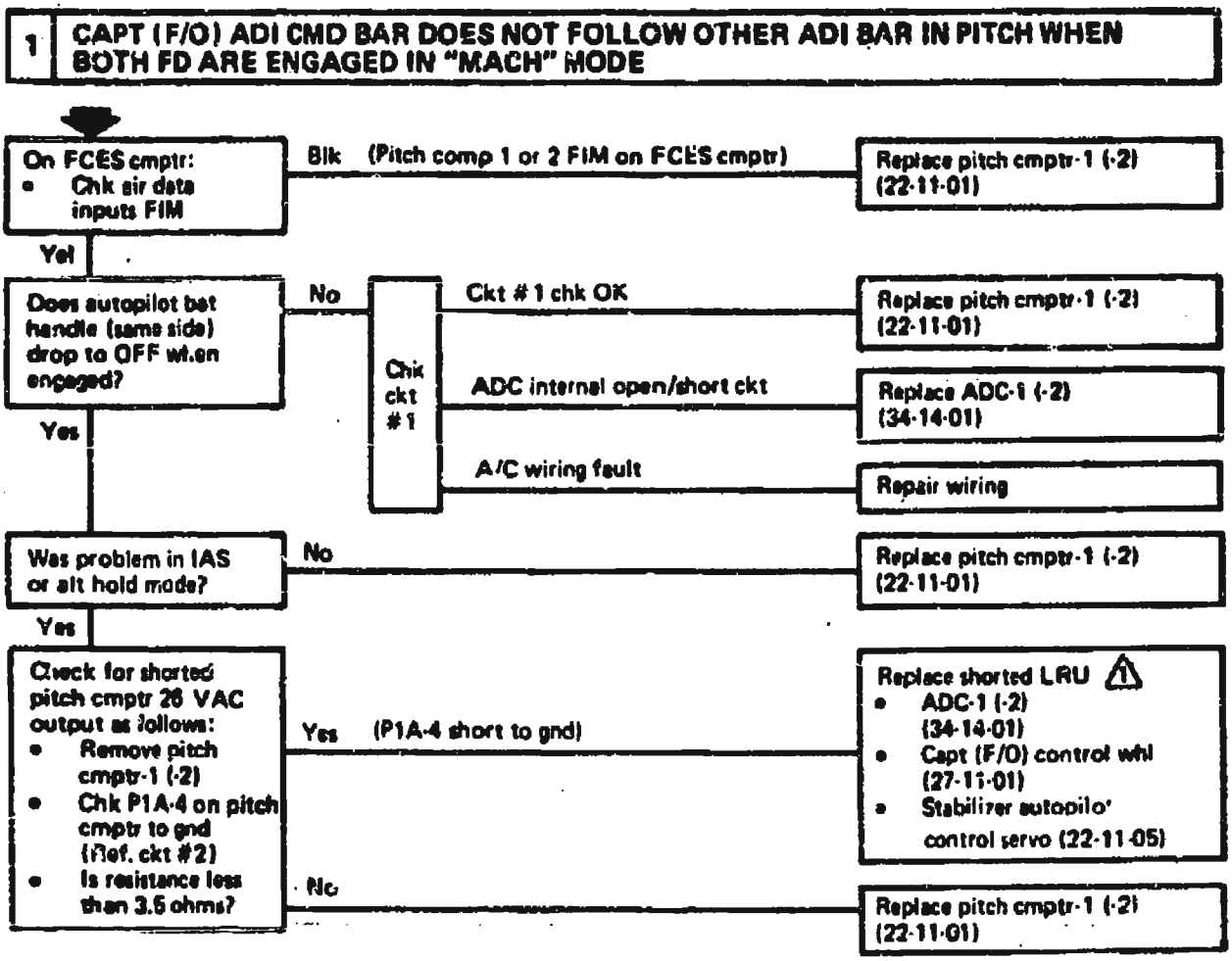
R FD MACH Hold Mode Fault Matrix
R Figure 103

R EFFECTIVITY: ALL

001B


1 CAPT (F/O) ADI CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN PITCH WHEN BOTH FD ARE ENGAGED IN "MACH" MODE
On FCES cmptr:
• Chk air data inputs FIM
Blk (Pitch comp 1 or 2 FIM on FCES cmptr)
Replace pitch cmptr-1 (-2) (22-11-01)
Yes
Does autopilot bat handle (same side) drop to OFF when engaged?
No
Chk ckt #1
Ckt #1 chk OK
Replace pitch cmptr-1 (-2) (22-11-01)
ADC internal open/short ckt
Replace ADC-1 (-2) (34-14-01)
A/C wiring fault
Repair wiring
Yes
Was problem in IAS or alt hold mode?
No
Replace pitch cmptr-1 (-2) (22-11-01)
Yes
Check for shorted pitch cmptr 26 VAC output as follows:
• Remove pitch cmptr-1 (-2)
• Chk P1A-4 on pitch cmptr to gnd (Ref. ckt #2)
• Is resistance less than 3.5 ohms?
Yes (P1A-4 short to gnd)
Replace shorted LRU ⚠
• ADC-1 (-2) (34-14-01)
• Capt (F/O) control whl (27-11-01)
• Stabilizer autopilot control servo (22-11-05)
No
Replace pitch cmptr-1 (-2) (22-11-01)

NOTE

⚠ Replace pitch cmptr-1 (-2) after faulted (shorted) LRU is replaced

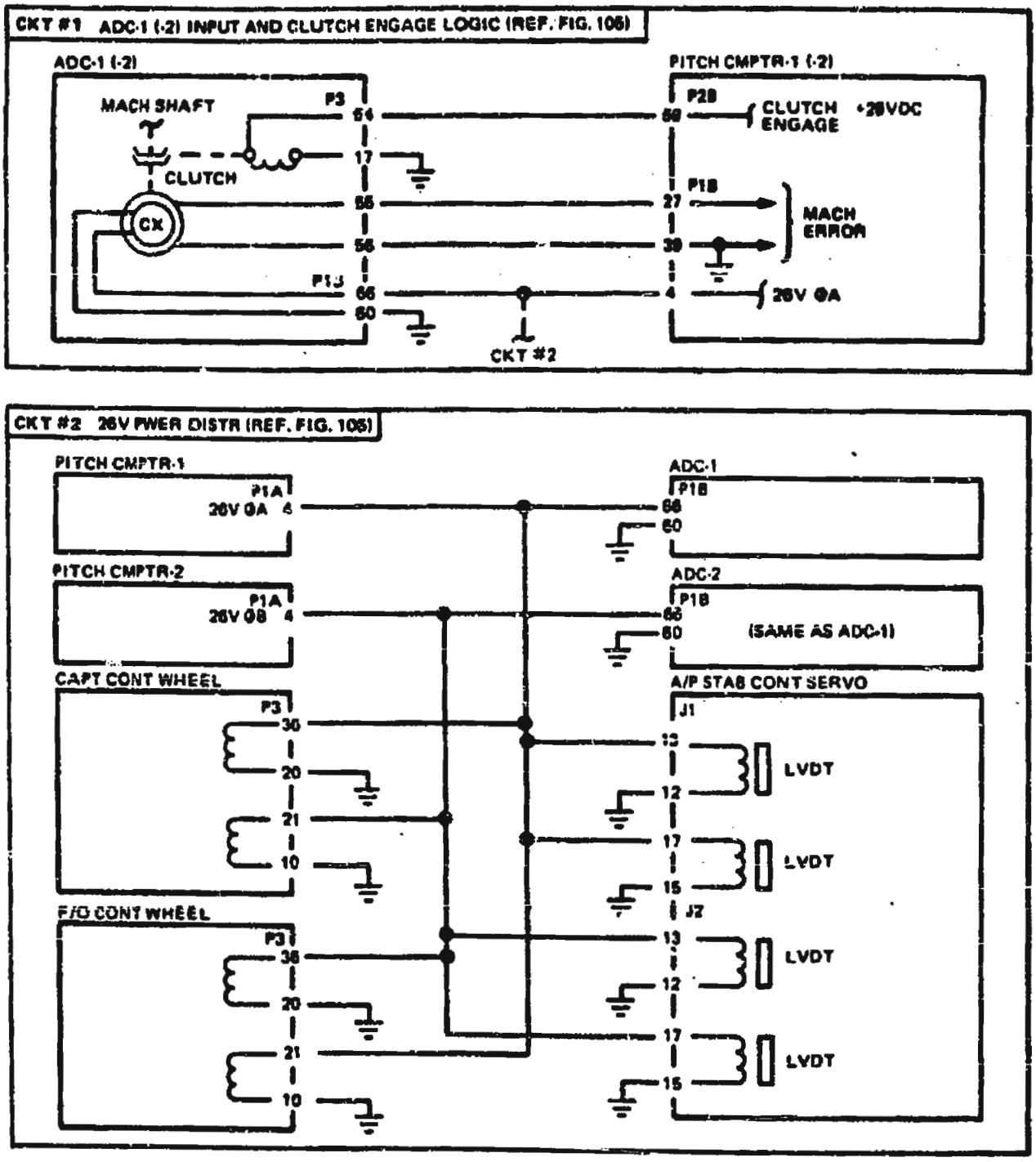
2 For FIRM codes followed by -2, use LRU in parenthesis ( )

M1-0001-22-1077

R FD MACH Hold Mode Faults
R Figure 104 (Sheet 1)

R EFFECTIVITY: ALL
R
001B

1 CONTINUED

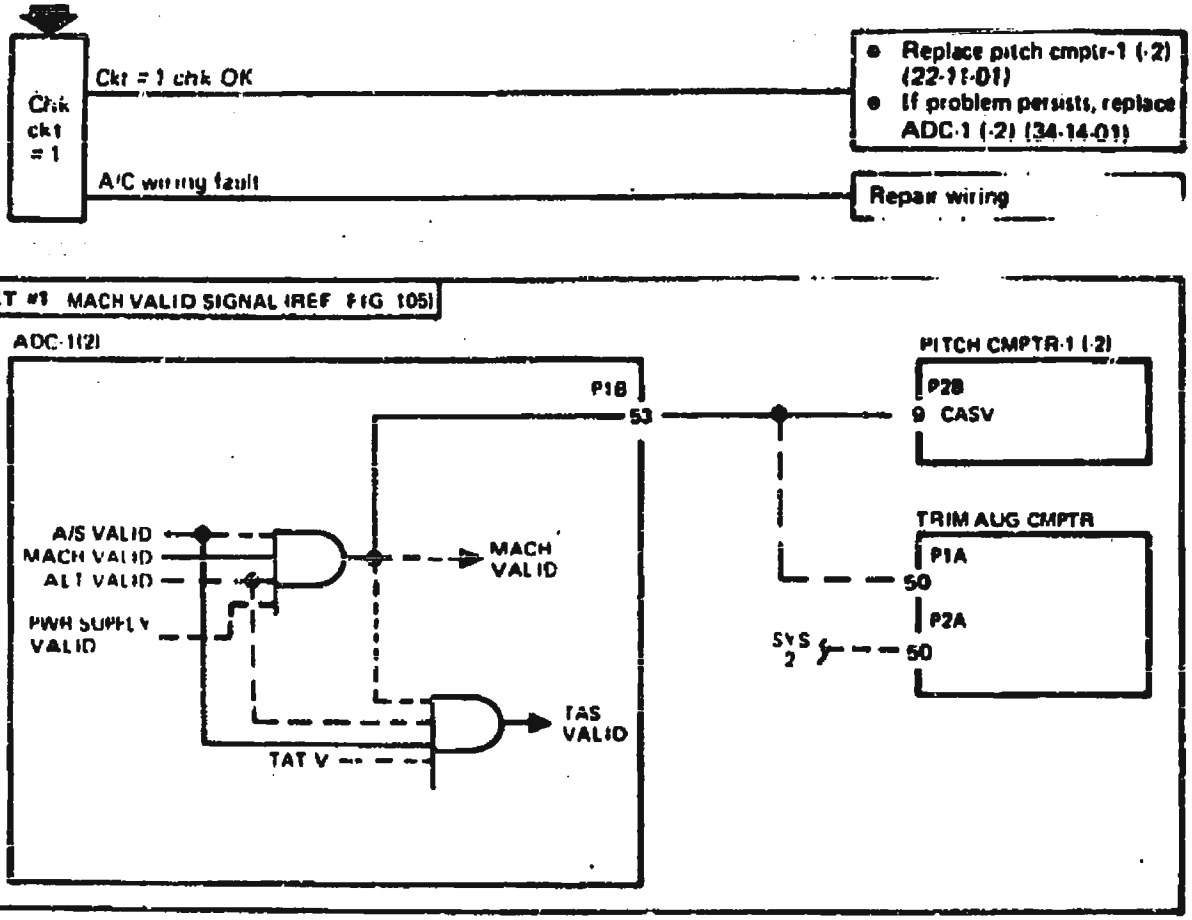


M1-0001-22-1078

FD MACH Hold Mode Faults
Figure 104 (Sheet 2)

EFFECTIVITY: ALL

2	FD FLAG IN-VIEW, CMD BAR OUT-OF-VIEW ON CAPT (F/O) ADI WHEN BOTH FD ARE ENGAGED IN "MACH" MODE. AP (SAME SIDE) DROPS FROM CMD TO CWS (CMD DISC) IF TURNED ON



NOTE
For FIRM codes followed by -2 use LRU in parenthesis ( )

MI-0001-22-1079

FD MACH Hold Mode Faults
Figure 104 (Sheet 3)

EFFECTIVITY: ALL

001B

3	"MACH" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "MACH" MODE. CMD BAR (SAME SIDE) FOLLOWS OTHER CMD BAR IN PITCH

Mode ann fault

On Capt (F/O) AFCS modes ann:
- Depress TEST 2 sw.
- MACH message is displayed on AFCS modes ann.
- MACH light (on hdg/pitch mode pnl) comes on

No "MACH" message → Replace Capt (F/O) AFCS modes ann (22-10-05)

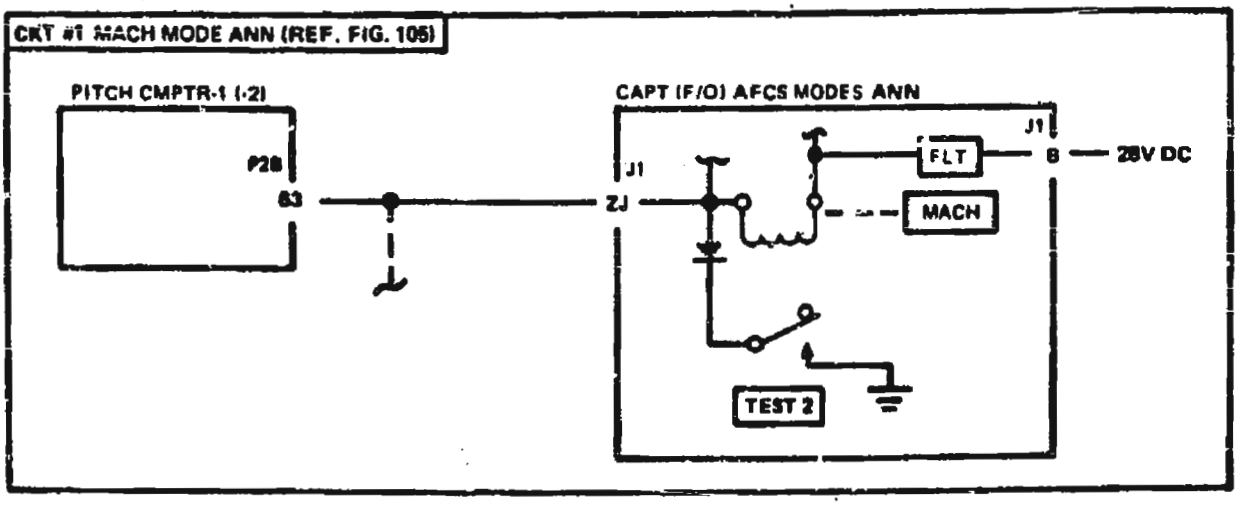
No "MACH" light → Chk ckt #1
- A/C wiring fault → Repair wiring
- AFCS modes ann has internal open ckt → Replace Capt (F/O) AFCS modes ann (22-10-05)

TEST 2 OK

Swap pitch cmptr-1 and -2 → Trouble follows pitch cmptr → Replace pitch cmptr-1 (-2) (22-11-01)

A/C wiring fault → Repair wiring P28-83 to J1-ZJ (Ref. ckt #1)

NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( ).

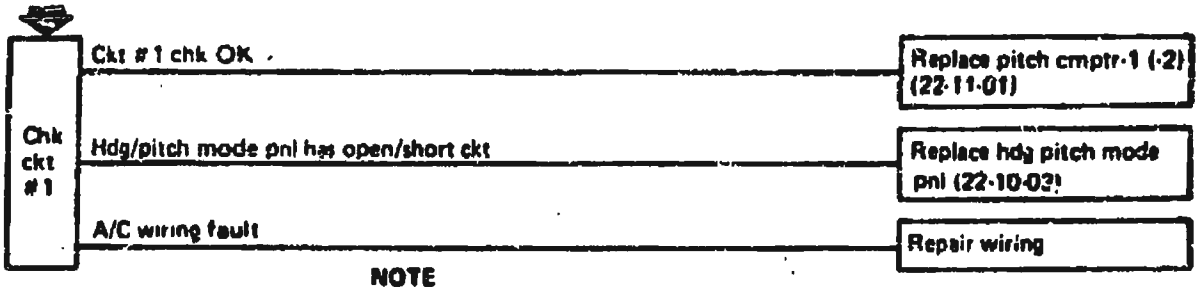


M1-0002-22-1000

FD MACH Hold Mode Fault
Figure 104 (Sheet 4)

EFFECTIVITY: ALL

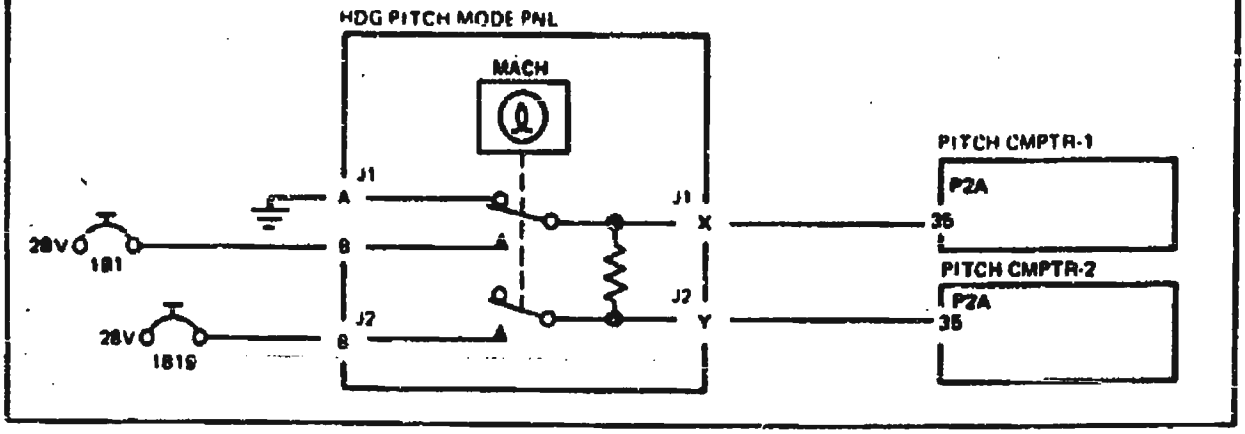
4	"MACH" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "MACH" MODE. CMD BAR (SAME SIDE) DOES NOT FOLLOW OTHER CMD BAR IN PITCH


Chk ckt #1
Ckt #1 chk OK
Replace pitch cmptr-1 (-2) (22-11-01)
Hdg/pitch mode pnl has open/short ckt
Replace hdg pitch mode pnl (22-10-03)
A/C wiring fault
Repair wiring

NOTE

For FIRM codes followed by 2, use LRU in parenthesis ( ).

CKT #1 MACH ENGAGE SIGNAL (REF. FIG. 106)



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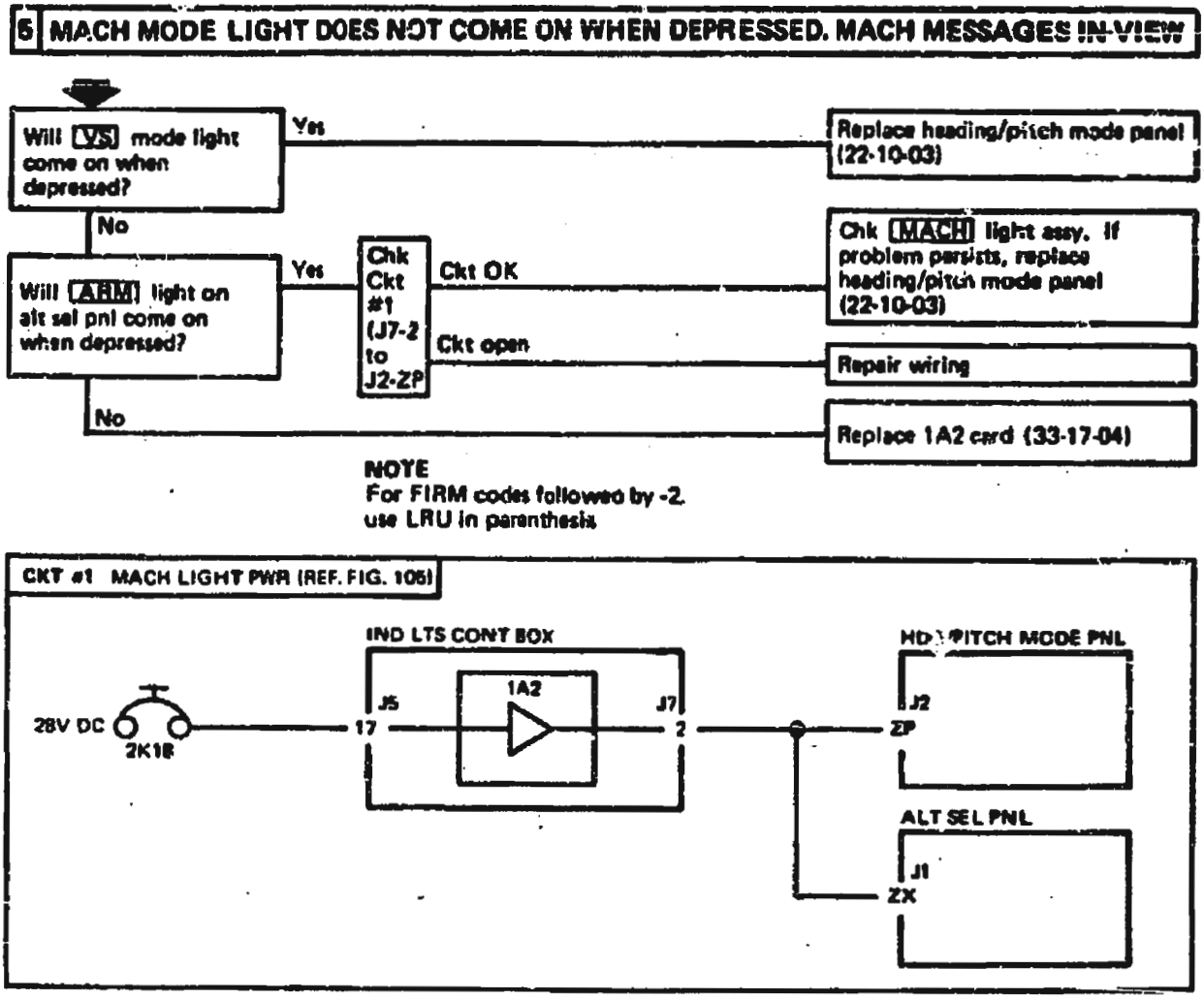
R FD MACH Hold Mode Faults
R Figure 104 (Sheet 5)

R EFFECTIVITY: ALL
R
001B



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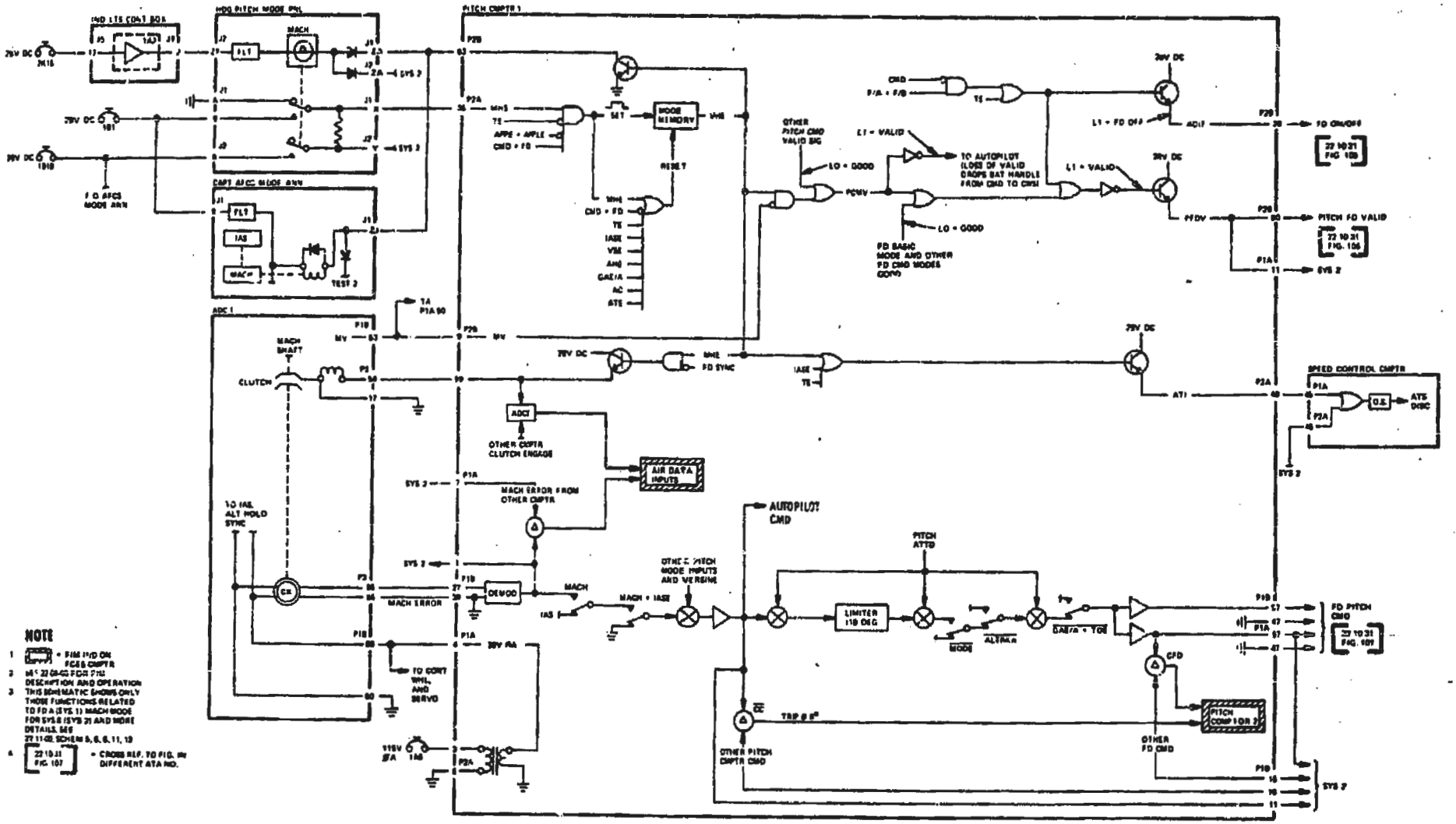
FD MACH Hold Mode Faults
Figure 104 (Sheet 6)

EFFECTIVITY: ALL


NOTE
1 = PINS PVD ON FCES CMPTR
2 REF 22-08-00 FOR FMC DESCRIPTION AND OPERATION
3 THIS SCHEMATIC SHOWS ONLY THOSE FUNCTIONS RELATED TO FD A (SYS 1) MACH MODE FOR SYS 2 (SYS 2) AND MORE DETAILS, SEE 22 11-00, SCHEM 5, 6, 6.11, 10
4 22 10 31 FIG 107 = CROSS REF. TO FIG. IN DIFFERENT ATA NO.
MACH
MACH ERROR
MODE MEMORY
AUTOPILOT CMD
PITCH ATTD
LIMITER 10 DEG
AIR DATA INPUTS
SPEED CONTROL CMPTR
FD PITCH CMD
PITCH FD VALID
FD ON/OFF
SYS 2
SYS 3

FD MACH Hold Simplified Schematic
Figure 105

EFFECTIVITY: ALL

R

FD MACH HOLD MODE - ADJUSTMENT AND TEST

R 1. General

R The fault detection test procedure in Paragraph 4 is used in
R conjunction with the fault isolation procedure in Paragraph 5.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 5 for appropriate fault isolation.

R 2. Equipment and Material

R Type MB-1 Pitot/Static Field Tester; Burton 2024B Pitot/Static
R Tester, or equivalent (2 req)

R 3. Referenced Procedures

R	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	Flight Director Basic Mode - Fault Isolation

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00, maintenance
R practices.

R B. FD Mach Hold Mode Test

R (1) On FCES panel, set ATS 1 and 2 switchlights to on
R (dark).

R (2) Set all throttle levers to mid-position.

R (3) On APFDS ENGAGE panel, set both FD switches to ON.

R RESULT:

R Both ADI command bars come into view and are
R level.

R Both ADI FD flags are out of view.

R (4) On HEADING/PITCH MODE panel, depress MACH switchlight
R to on.

R RESULT:

R On both AFCS MODES annunciators, MACH messages are
R displayed.

R On both ADIs, FD flags are out of view, and
R command bars are centered and level.

R (5) Depress MACH switchlight to off.

R RESULT:

R MACH messages are removed.

R (6) If not connected, connect air data testers to CADC
R systems No. 1 and 2. On each tester, establish an
R airspeed of 350 knots and an altitude of 7,350 feet
R (approximately 0.6 Mach number).

R (7) Depress MACH switchlight to on.

R RESULT:

R Both MACH messages are displayed.

R Both FD flags are out of view, and both command
R bars are centered.

R (8) On both air data testers, decrease airspeed to 300
R knots.

R RESULT:

R On both ADIs, command bars move down.

R (9) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit
R breaker.

R RESULT:

R On F/O AFCS MODES annunciator, MACH message is
R removed.

R On F/O ADI, FD flag is displayed and command bar
R is biased out of view.

R (10) On THRUST select panel, set IAS control to 350 knots,
R and set ATS switch to ON (up position).

R RESULT:

R MACH switchlight goes out.

R On Capt AFCS MODES annunciator, MACH message goes
R out of view.

R (11) Depress MACH switchlight to on.

R RESULT:

R On Capt AFCS MODES annunciator, MACH message is
R displayed.

R ATS switch drops to OFF.

R On both AFCS WARNING indicators, ATS DISC messages
R are displayed.

R (12) Reset ATS DISC warning by depressing ATS DISC switch on
R outboard throttle lever.

R (13) Set both FD switches to OFF.

R (14) Close A24 circuit breaker.

R (15) Set both FD switches to ON.

R (16) Depress MACH switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, MACH messages are
R displayed.

R (17) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit
R breaker.

R RESULT:

R On Capt AFCS MODES annunciator, MACH message is
R removed.

R On Capt ADI, FD flag is displayed and command bar
R is biased out of view.

R (18) Set ATS switch to ON.

R RESULT:

R On HEADING/PITCH MODE panel, MACH switchlight goes
R out.

R On F/O AFCS MODES annunciator, MACH message goes
R out of view.

R (19) Depress MACH switchlight to on.

R RESULT:

R On F/O AFCS MODES annunciator, MACH message is
R displayed.

R ATS switch drops to OFF.

R On both AFCS WARNING indicators, ATS DISC messages
R are displayed.

R Reset ATS DISC warning by depressing ATS DISC
R switch on outboard throttle lever.

R (20) Set both FD switches to OFF.

R (21) Close A6 circuit breaker.

R (22) Set both FD switches to ON.

R (23) Depress MACH switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, MACH messages are
R displayed.

R (24) On CB1, open AIR DATA CMPTR (G8) and (G27) circuit
R breakers.

R RESULT:

R On both ADIs, FD flags are displayed, and command
R bars are biased out of view.

R (25) Close G8 and G27 circuit breakers.

R (26) On each air data tester, establish zero airspeed and
R ambient altitude.

R (27) Set both FD switches to OFF.

R 5. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R FD Mach Hold Mode Fault Isolation Summary
R Table 501

TEST REF.	FAULT	FAULT NO.
4B(1)	ATS switchlight not dark	(1)
4B(3)	ADI fault indication	(2)
4B(4)-1	MACH switchlight not illuminated	(3)
4B(4)-2	MACH message not displayed on Capt AFCS MODES annunciator	(4)
4B(4)-3	MACH message not displayed on F/O AFCS MODES annunciator	(5)
4B(4)-4	Capt ADI FD flag displayed	(6)
4B(4)-5	Capt ADI command bar not centered	(7)
4B(4)-6	F/O ADI FD flag displayed	(8)
4B(4)-7	F/O ADI command bar not centered	(9)
4B(5)	MACH switchlight remains illuminated	(10)
4B(8)-1	Capt ADI command bar motion incorrect	(11)
4B(8)-2	F/O ADI command bar motion incorrect	(12)
4B(9)-1	MACH message not removed on F/O AFCS MODES annunciator	(13)
4B(9)-2	No F/O ADI fault indication	(14)

FD Mach Hold Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(10)	MACH switchlight remains illuminated	(15)
4B(11)-1	ATS switch does not drop to OFF	(16)
4B(11)-2	ATS DISC message not displayed on Capt AFCS WARNING indicator	(17)
4B(11)-3	ATS DISC message not displayed on F/O AFCS WARNING indicator	(18)
4B(17)-1	MACH message not removed on Capt AFCS MODES annunciator	(19)
4B(17)-2	No F/O ADI fault indication	(20)
4B(18)	MACH switchlight remains illuminated	(21)
4B(19)	ATS switch does not drop to OFF	(22)
4B(24)-1	No Capt ADI fault indication	(23)
4B(24)-2	No F/O ADI fault indication	(24)

Schematics for Fault Isolation of FD Mach Hold Mode Problem
Table 502

TITLE	LOCATION
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
Turbulance, Vertical Speed, Indicated Air Speed, and Mach Hold Engage Logic Schematic	22-11-00, Schem 13

R B. FD Mach Hold Mode Faults

R (1) Fault: ATS switchlight not dark

R (a) On HEADING/PITCH MODE panel, set MACH switchlight
R to on. On Capt or F/O ADI, is FD flag displayed?

R Yes: Check air data system associated with ADI
R indicating a fault condition (Ref. 34-14-00).

R No: Check speed control system for fault (Ref.
R 22-31-00).

R ---

R (2) Fault: ADI fault indication

R (a) Perform Steps (1) and (2) of FD basic mode test
R procedure (Ref. 22-10-31).

R ---

R (3) Fault: MACH switchlight not illuminated

R (a) Can lamp test procedure (Ref. 22-02-01) be
R performed with no indicated MACH switchlight
R fault?

R Yes: Replace HEADING/PITCH MODE panel (Ref.
R 22-10-03).

R No: Perform lamp fault isolation procedure (Ref.
R 22-02-01).

R ---

R (4) Fault: On Capt AFCS MODES annunciator, MACH message
R not displayed

R (a) Can mode annunication press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated
R MACH message fault?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01). If problem persists, replace
R HEADING/PITCH MODE panel (Ref. 22-10-03). If
R problem persists, replace Capt AFCS MODES
R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R ---

R (5) Fault: On F/O AFCS MODES annunciator, MACH message not displayed

R (a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated MACH message fault?

R Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (6) Fault: Capt ADI FD flag displayed

R (a) On Capt MACH/AIRSPEED indicator, is MACH flag displayed?

R Yes: Check air data system No. 1 for fault (Ref. 34-14-00).

R No: Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (7) Fault: Capt ADI command bar not centered

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (8) Fault: F/O ADI FD flag displayed

R (a) On F/O MACH/AIRSPEED indicator, is MACH flag displayed?

R Yes: Check air data system No. 2 for fault (Ref. 34-14-00).

R No: Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (9) Fault: F/O ADI command bar not centered

R (a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (10) Fault: On HEADING/PITCH MODE panel, MACH switchlight
R remains illuminated

R (a) On Capt AFCS MODES annunciator, is MACH message
R displayed?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01). If problem persists, replace
R HEADING/PITCH MODE panel (Ref. 22-10-03).

R No: Replace pitch computer No. 2 (Ref. 22-11-01).
R If problem persists, replace HEADING/PITCH MODE
R panel (Ref. 22-10-03).

R ---

R (11) Fault: Capt ADI command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Go to Step (b).

R No: Go to Step (c).

R (b) Can vertical speed mode test procedure (Ref.
R 22-11-31) be performed with no indicated faults?

R Yes: Replace pitch computer No. 1 (Ref.
R 22-11-01). If problem persists, check air data
R system No. 1 for fault (Ref. 34-14-00).

R No: Perform vertical speed mode fault isolation
R procedure (Ref. 22-11-31).

R (c) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT
R DIR switchlight to illuminate ALTN legend. Does
R F/O ADI command bar command nose-down?

R Yes: Replace heading coupler accessory unit (Ref.
R 34-22-06). If problem persists, replace Capt ADI
R (Ref. 34-21-07).

R No: Replace pitch computer No. 1 (Ref. 22-11-01).
R If problem persists, replace heading coupler
R accessory unit (Ref. 34-22-06).

R ---

R (12) Fault: F/O ADI command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Go to Step (b).

R No: Go to Step (c).

R (b) Can vertical speed mode test procedure (Ref. R 22-11-31) be performed with no indicated faults?

R Yes: Replace pitch computer No. 2 (Ref. R 22-11-01). If problem persists, check air data R system No. 2 for fault (Ref. 34-14-00).

R No: Perform vertical speed mode fault isolation R procedure (Ref. 22-11-31).

R (c) On Capt INSTRUMENT SOURCE SELECT panel, depress R FLT DIR switchlight to illuminate ALTN legend. R Does Capt ADI command bar command nose-down?

R Yes: Replace heading coupler accessory unit (Ref. R 34-22-06). If problem persists, replace F/O ADI R (Ref. 34-21-07).

R No: Replace pitch computer No. 2 (Ref. 22-11-01). R If problem persists, replace heading coupler R accessory unit (Ref. 34-22-06).

R ---

R (13) Fault: On F/O AFCS MODES annunciator, MACH message not R removed

R (a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (14) Fault: No F/O ADI fault indication

R (a) Replace F/O ADI (Ref. 34-21-07).

R ---

R (15) Fault: On HEADING/PITCH MODE panel, MACH switchlight R remains illuminated

R (a) On THRUST panel, does ATS switch remain in up R position?

R Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

R No: Check speed control system for fault (Ref. 22-31-00).

R ---

R (16) Fault: On THRUST panel, ATS switch does not drop to OFF

R (a) Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

R ---

R (17) Fault: On Capt AFCS WARNING indicator, ATS DISC message not displayed

R (a) Can warning annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ATS DISC message fault?

R Yes: Check speed control system for fault (Ref. 22-31-00). If problem persists, replace Capt AFCS WARNING indicator (Ref. 22-10-06).

R No: Perform warning annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (18) Fault: On F/O AFCS WARNING indicator, ATS DISC message not displayed

R (a) Can warning annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated ATS DISC message fault?

R Yes: Check speed control system for fault (Ref. 22-31-00). If problem persists, replace F/O AFCS WARNING indicator (Ref. 22-10-06).

R No: Perform warning annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (19) Fault: On Capt AFCS MODES annunciator, MACH message not removed

R (a) Replace pitch computer No. 1(Ref. 22-11-01).

R ---

R (20) Fault: No F/O ADI fault indication

R (a) Replace Capt ADI (Ref. 34-21-07).

R ---

R (21) Fault: On HEADING/PITCH MODE panel, MACH switchlight remains illuminated

R (a) On THRUST panel, does ATS switch remain in up position?

R Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

R No: Check speed control system for fault (Ref. 22-31-00).

R ---

R (22) Fault: On THRUST panel, ATS switch does not drop to OFF

R (a) Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check speed control system for fault (Ref. 22-31-00).

R ---

R (23) Fault: No Capt ADI fault indication

R (a) On CB1, open NO. 1 SYSTEMS/PITCH & ROLL (A6) circuit breaker. On Capt ADI, is FD flag displayed?

R Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

R No: Replace Capt ADI (Ref. 34-21-07).

R ---

R (24) Fault: No F/O ADI fault indication

R (a) On CB1, open NO. 2 SYSTEMS/PITCH & ROLL (A24) circuit breaker. On F/O ADI, is FD flag displayed?

R Yes: Replace pitch computer No. 2 (Ref.
R 22-11-01).

R No: Replace F/O ADI (Ref. 34-21-07).

R ---

TURBULENCE MODE - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting Tubulence Mode faults are included in this section of the manual. A Turbulence Mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use Turbulance Mode Fault Matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the fault isolation diagrams and schematics. Figure 101 and 102 provide component location for Turbulance Mode troubleshooting.

R A. General

Turbulence mode fault isolation contains two levels of troubleshooting: (1) fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2B) trouble shoots a specific turbulence mode problem. System oriented fault isolation (Ref. 22-11-43, Page 501) tests and trouble shoots turbulence mode problems.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the turbulence mode by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-11-43, Page 501) to isolate problem.

R Figure 104 provides diagnostic steps to further isolate the
R fault. The diagnostic steps are in a flow chart form which
R contains complete fault isolation procedures for each fault.
R Action instructions are contained within the blocks of the
R flow chart while the monitored results of the actions are
R outside the blocks. When using the flow charts, it is
R assumed that systems are in the normal operational mode, all
R relevant breakers have been checked, and all applicable
R aircraft operational procedures have been accomplished.

R Fault Location Diagrams and Schematics List
R Table 101

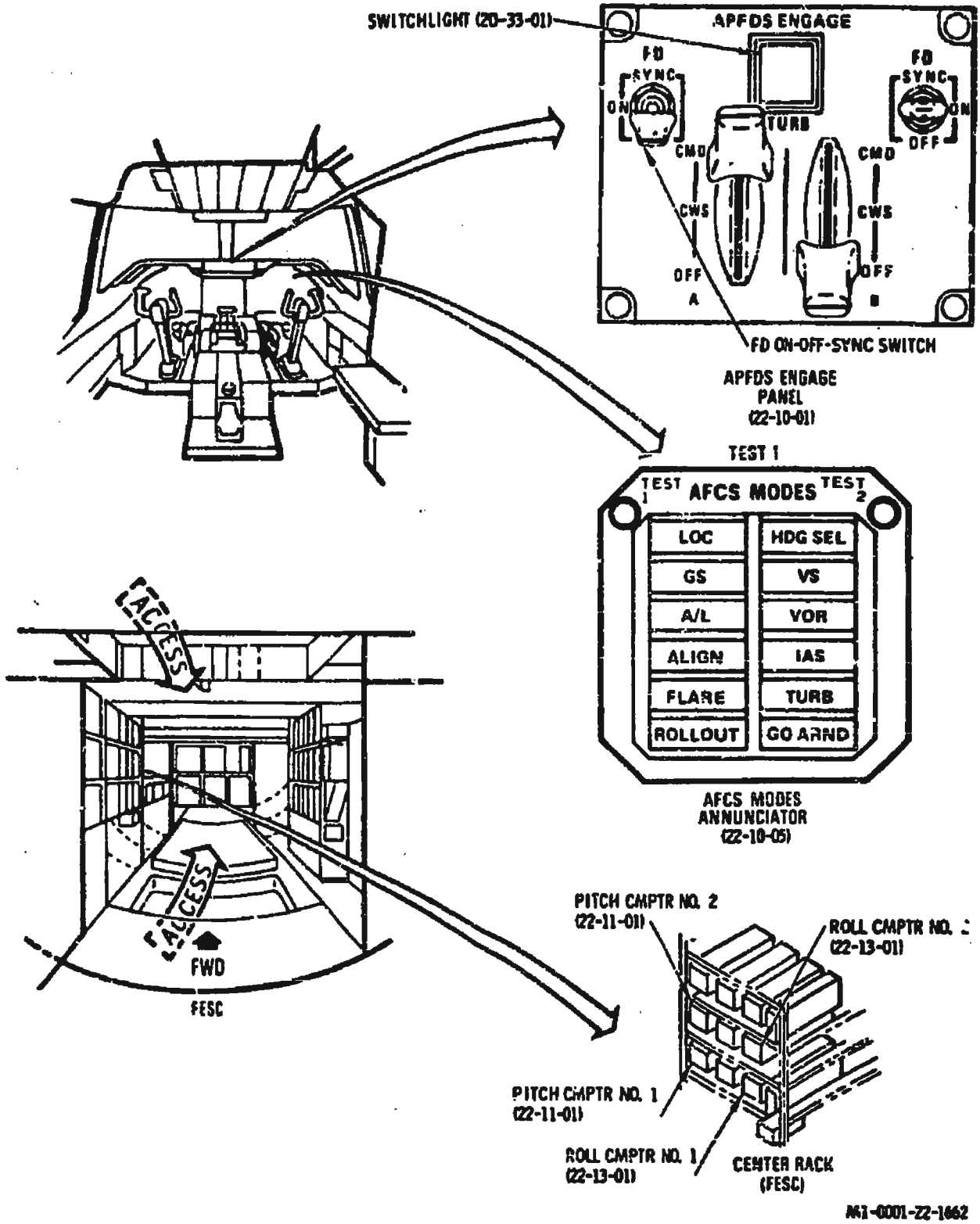
FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Turbulence Mode Fault Matrix
104	Turbulence Mode Faults
105	Turbulence Mode Simplified Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – PITCH	2	FESC/CTR RACK/112AR	22-11-01
COMPUTER – ROLL	2	FESC/CTR RACK/112AB	22-13-01
INDICATOR – AFCS MODES	2	FLT STA, CAPT & F/O INSTR PNL	22-10-05
PANEL – APFDS ENGAGE	1	FLT STA, GLARESHIELD	22-10-01
SWITCHLIGHT–		FLT STA, APFDS ENGAGE PNL	20-33-01

M1-0000-22-2191

R Component Location Index
R Figure 101

R EFFECTIVITY: ALL
R
0018



R
R Component Locator Diagram
Figure 102

R EFFECTIVITY: ALL
R
R
001B

FAULTS → FIM → NO FIM

No.	Problem (Capt or F/O)	Troubleshooting Faulty LRU				
	Capt FIRM Codes With -1 / F/O FIRM Codes With -2 / X = Use With Both FIRM Codes	Check FIM on LRU or on Front Panel of FCES Cmptr		Continuity Check or Replace		
		PC	RC	APFDS ENG PNL	MODES ANN	LT ASSY
TURB MODE FAULTS (Ref. Fig. 104)						
1	Force required for control wheel movement was not increased in TURB mode with AP A (B) engaged. Sys operates normal when other AP is engaged	1/2	1/2			
2	Force required for control column movement was not increased in TURB mode with AP A (B) engaged. Sys operates normal when other AP is engaged	1/2				
3	When TURB mode is engaged, TURB message did not appear on Capt (F/O) AFCS MODES ann. Message appears during AFCS MODES ann. TEST 1	1/2			C/F	
4 ⚠1	AP will not accept TURB mode.	1/2		X		X
5	One of the following modes did not disengage when TURB mode was engaged (IAS, MACH or V NAV, ALT HOLD)	1/2				
6	HDG SEL mode did not disengage when TURB mode was engaged	1/2	1/2			
7	Capt (F/O) ADI cmd bars did not bias out of view when TURB mode was engaged	1/2				

NOTE

⚠1 Replace pitch cmptr-1 and -2 when short is cleared

Abbreviations		Remove and Install Ref.	
		Chapt.	Page
APFDS ENG PNL	APFDS engage pnl	22-10-01	401
LT ASSY	Light assembly	20-33-01	401
MODE ANN	AFCS MODES annunciator indicator	22-10-05	401
PC	Pitch computer	22-11-01	401
RC	Roll computer	22-13-01	401
1 or C	No. 1 LRU associated with system No. 1 Problem		
2 or F	No. 2 LRU associated with system No. 2 Problem		
X	One LRU Common to both System		

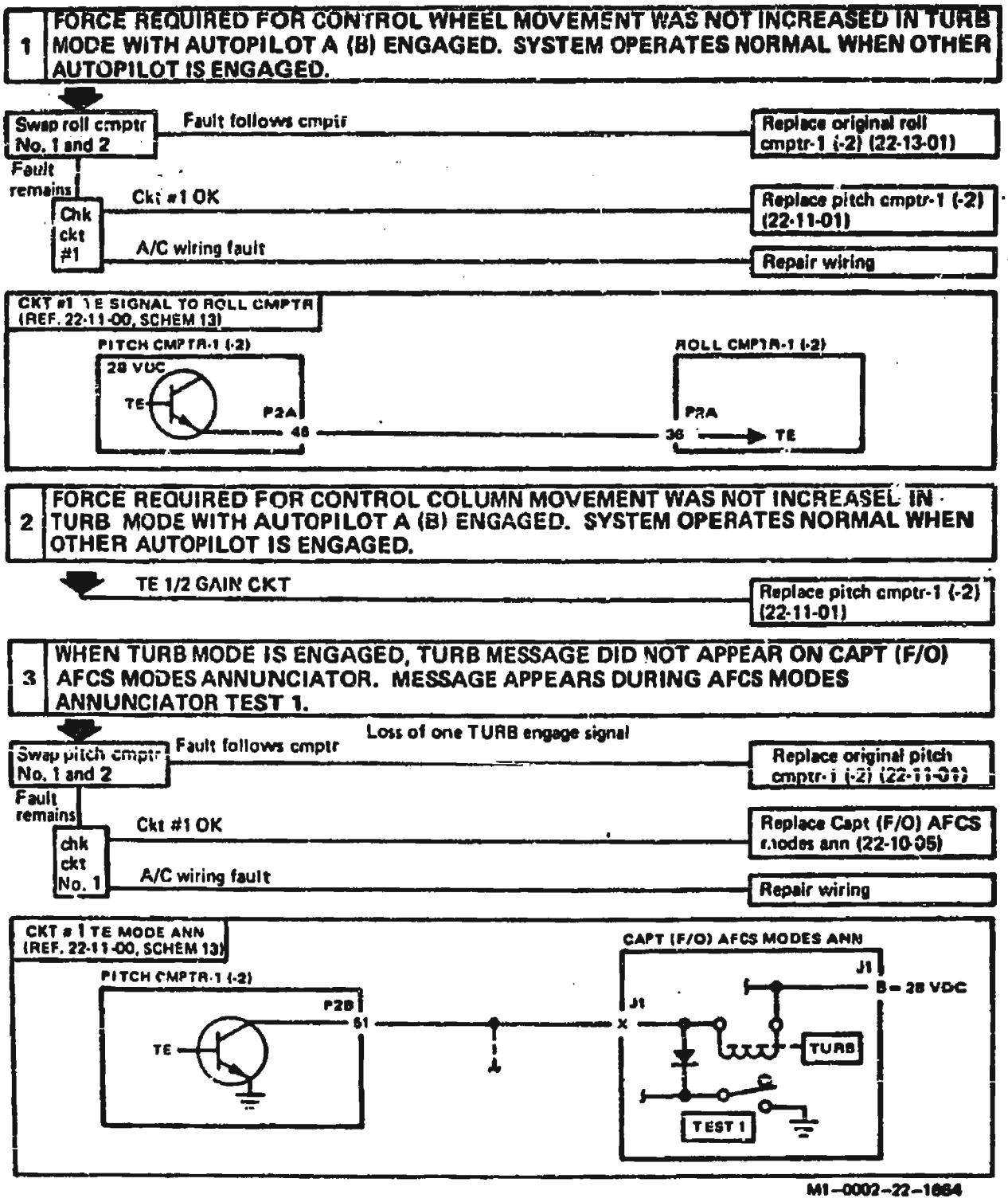
HOW TO USE:

1. Find flight squawk in FAULTS column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 or 105

M1—0001—22—1663

R R Turbulence Mode Fault Matrix
Figure 103

R R 001B EFFECTIVITY: ALL


1 FORCE REQUIRED FOR CONTROL WHEEL MOVEMENT WAS NOT INCREASED IN TURB MODE WITH AUTOPILOT A (B) ENGAGED. SYSTEM OPERATES NORMAL WHEN OTHER AUTOPILOT IS ENGAGED.
Swap roll cmptr No. 1 and 2
Fault follows cmptr
Replace original roll cmptr-1 (-2) (22-13-01)
Fault remains
Chk ckt #1
Ckt #1 OK
Replace pitch cmptr-1 (-2) (22-11-01)
A/C wiring fault
Repair wiring
CKT #1 TE SIGNAL TO ROLL CMPTR (REF. 22-11-00, SCHEM 13)
PITCH CMPTR-1 (-2)
28 VDC
TE
P2A
48
ROLL CMPTR-1 (-2)
P2A
36
TE
2 FORCE REQUIRED FOR CONTROL COLUMN MOVEMENT WAS NOT INCREASEL IN TURB MODE WITH AUTOPILOT A (B) ENGAGED. SYSTEM OPERATES NORMAL WHEN OTHER AUTOPILOT IS ENGAGED.
TE 1/2 GAIN CKT
Replace pitch cmptr-1 (-2) (22-11-01)
3 WHEN TURB MODE IS ENGAGED, TURB MESSAGE DID NOT APPEAR ON CAPT (F/O) AFCS MODES ANNUNCIATOR. MESSAGE APPEARS DURING AFCS MODES ANNUNCIATOR TEST 1.
Loss of one TURB engage signal
Swap pitch cmptr No. 1 and 2
Fault follows cmptr
Replace original pitch cmptr-1 (-2) (22-11-01)
Fault remains
chk ckt No. 1
Ckt #1 OK
Replace Capt (F/O) AFCS modes ann (22-10-05)
A/C wiring fault
Repair wiring
CKT # 1 TE MODE ANN (REF. 22-11-00, SCHEM 13)
PITCH CMPTR-1 (-2)
P2B
51
TE
CAPT (F/O) AFCS MODES ANN
J1
B = 28 VDC
J1
X
TURB
TEST 1
M1-0002-22-1664

R
R

Turbulence Mode Faults
Figure 104 (Sheet 1)

EFFECTIVITY: ALL

001B

4	AUTOPILOT WILL NOT ACCEPT TURB MODE.

Loss of both TURB engage signals

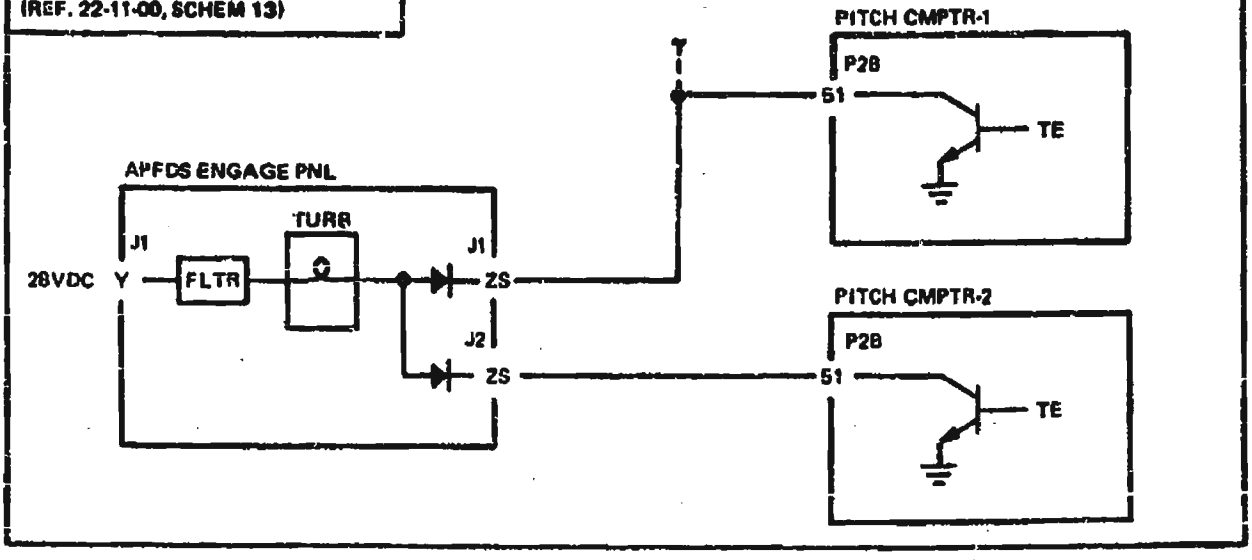
Turb light ckt shorted in APFDS ENGAGE panel causing transistors in both pitch cmptr to burn out.

Determine if short is in light assy or APFDS ENGAGE pnl (Ref. ckt #1)

Replace light assy (20-33-01) or APFDS ENGAGE pnl (22-10-01) as required

When short is cleared, replace both pitch cmptrs (22-11-01)

CKT #1 TURB LIGHT CONTROL CKT (REF. 22-11-00, SCHEM 13)



5	ONE OF THE FOLLOWING MODES DID NOT DISENGAGE WHEN TURB MODE WAS ENGAGED (IAS, MACH OR V NAV, ALT HOLD)

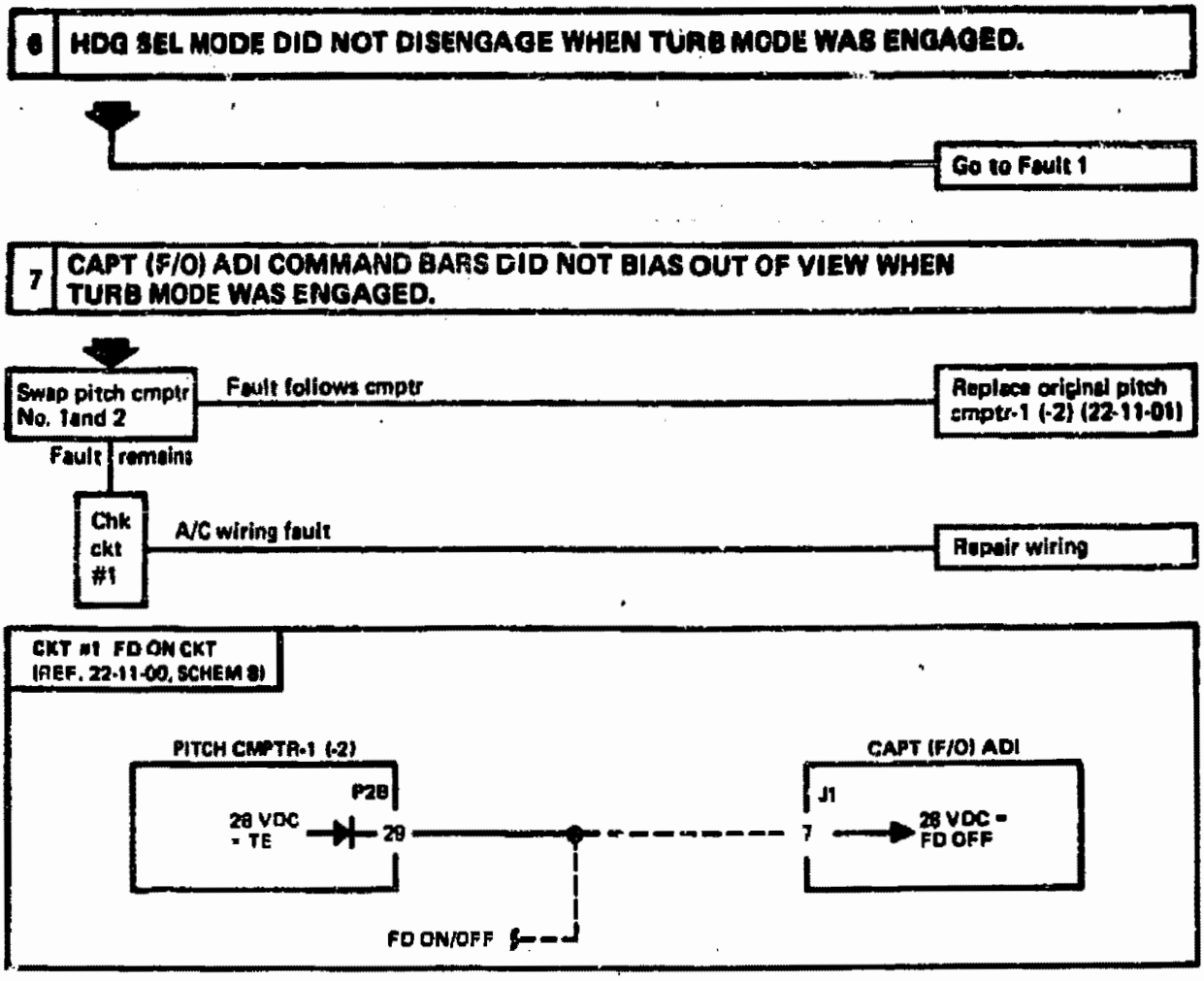
Replace pitch cmptr-1 (-2) (22-11-01)

M1-0002-22-1666

R Turbulence Mode Faults
R Figure 104 (Sheet 2)

EFFECTIVITY: ALL

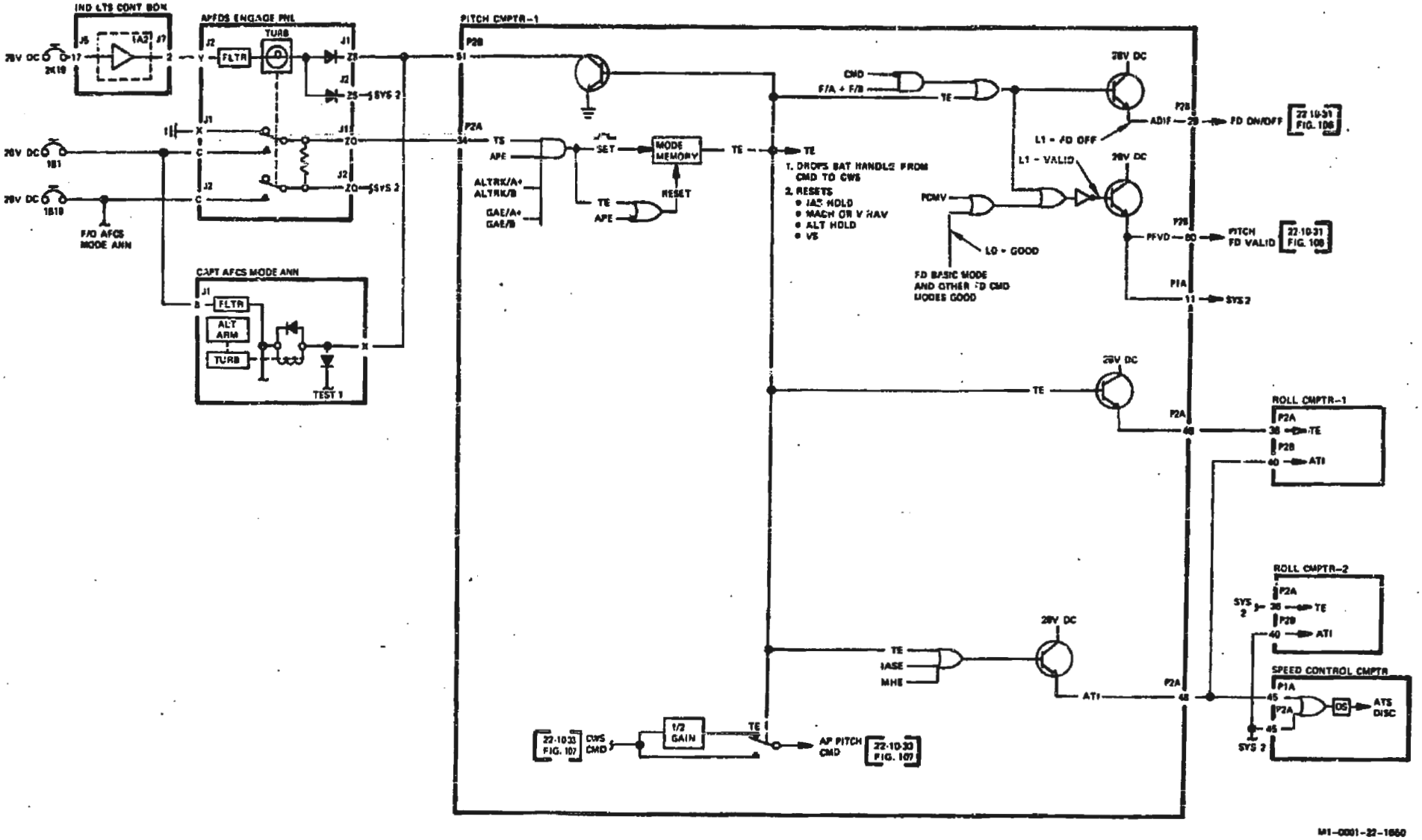
001B


6
HDG SEL MODE DID NOT DISENGAGE WHEN TURB MODE WAS ENGAGED.
Go to Fault 1
7
CAPT (F/O) ADI COMMAND BARS DID NOT BIAS OUT OF VIEW WHEN TURB MODE WAS ENGAGED.
Swap pitch cmptr No. 1and 2
Fault follows cmptr
Replace original pitch cmptr-1 (-2) (22-11-01)
Fault remains
Chk ckt #1
A/C wiring fault
Repair wiring
CKT #1 FD ON CKT (REF. 22-11-00, SCHEM 8)
PITCH CMPTR-1 (-2)
P2B
28 VDC - TE
29
CAPT (F/O) ADI
J1
7
28 VDC = FD OFF
FD ON/OFF

M1—0001—22—1666

R Turbulence Mode Faults
R Figure 104 (Sheet 3)

R EFFECTIVITY: ALL
R
001B



Autopilot Turbulence Mode Simplified Schematic
Figure 105

EFFECTIVITY: ALL

001B

R TURBULENCE MODE - ADJUSTMENT/TEST

R 1. General

R The fault detection test procedure in Paragraph 3 is used in
R conjunction with the fault isolation procedure in Paragraph 4.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 4 for appropriate fault isolation.

R 2. Referenced Procedures

R	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	FD Basic Mode - Fault Isolation
R	22-11-31	FD Vertical Speed Mode - Fault Isolation
R	22-13-31	FD Heading Select Mode - Fault Isolation
R	22-10-33	Autopilot A CWS/CMD Mode - Fault Isolation
R	22-10-35	Autopilot B CWS/CMD Mode - Adjustment and Test

R 3. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00, maintenance
R practices.

R B. Turbulence Mode Test

R (1) In FESC, install MLG accessory unit if removed.

R (2) On APFDS ENGAGE panel, set AP engage switch A to CWS.

R RESULT:

R Control column and wheel positions do not change.

R On both AFCS WARNING annunciators, AP LIMIT
R messages are not displayed.

R (3) On APFDS ENGAGE panel, set FD switches A and B to ON.

R RESULT:

R Both ADI command bars come into view and are
R level.

R Both ADI FD flags are out of view.

R (4) On APFDS ENGAGE panel, depress TURB switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, TURB messages are
R displayed.

R On both ADI, FD flags and command bars are out of
R view.

R (5) Set AP engage switch A to OFF.

R RESULT:

R On both AFCS WARNING annunciators, AP DISC
R messages and flashing ALERT lights are displayed.

R On both AFCS MODE annunciators, TURB messages are
R removed.

R On both ADI, command bars are in view.

R (6) On HEADING/PITCH MODE panel, depress VS switchlight to
R on.

R RESULT:

R On both AFCS MODES annunciators, VS messages are
R displayed.

R On both ADI, FD flags are out of view and command
R bars are centered and level.

R (7) On HEADING/PITCH MODE panel, depress HDG switchlight to
R on.

R RESULT:

R On both AFCS MODES annunciators, HDG SEL messages
R are displayed

R On both ADI, FD flags are out of view and command
R bars are centered and level.

R (8) Set AP engage switch A to CMD.

R RESULT:

R On both AFCS WARNING annunciators, AP DISC and
R flashing ALERT light displays are removed.

R (9) Depress TURB switchlight to on. AP engage switch A
R drops to CWS.

R RESULT:

R On both AFCS MODES annunciators, VS and HDG SEL
R messages are removed and TURB messages are
R displayed.

R On both ADI, FD flags and command bars are out of
R view.

R (10) Set FD switches A and B to OFF.

R RESULT:

R On both ADI, FD flags and command bars are out of
R view.

R (11) Depress TURB switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, TURB messages are
R removed.

R (12) On Capt control wheel, slowly pull aft until a point
R approximately midway between neutral and full aft
R positions is reached.

R RESULT:

R AP engage switch A remains in CWS.

R On both AFCS WARNING annunciators, AP LIMIT
R messages are not displayed.

R Maintain control column position.

R (13) Depress TURB switchlight to on.

R RESULT:

R Force required to hold control wheel at existing
R position increases.

R (14) Release control wheel force.

R (15) Depress TURB switchlight to off.

R (16) Rotate Capt control wheel clockwise approximately 45 degrees.

R RESULT:

R AP engage switch A remains in CWS.

R Maintain control wheel position.

R (17) Depress TURB switchlight to on.

R RESULT:

R Force required to hold control wheel at existing position increases.

R (18) Release control wheel force. If AP engage switch A drops to OFF, go to Step (21).

R (19) Depress TURB switchlight to off.

R (20) Set AP engage switch A to OFF.

R (21) On APFDS ENGAGE panel, set AP engage switch B to CWS.

R RESULT:

R Control column and wheel positions do not change.

R On both AFCS WARNING annunciators, AP LIMIT messages are not displayed, and AP DISC and flashing ALERT light, displays are removed.

R (22) Set AP engage switch B to CMD.

R (23) Depress TURB switchlight to on.

R RESULT:

R AP engage switch B drops to CWS.

R (24) Depress TURB SWITCHLIGHT TO OFF.

R (25) On F/O control wheel, slowly pull aft until a point approximately midway between neutral and full aft positions is reached.

R RESULT:

R AP engage switch B remains in CWS.

R On both AFCS WARNING annunciators, AP LIMIT
R messages are not displayed.

R Maintain control column position.

R (26) Depress TURB switchlight to on.

R RESULT:

R Force required to hold control wheel at existing
R position increases.

R (27) Release control wheel force.

R (28) Set AP engage switch B to OFF.

R RESULT:

R On both AFCS WARNING annunciators, AP DISC message
R and flashing ALERT light are displayed.

R On both AFCS MODES annunciators, TURB messages are
R removed.

R (29) Set AP engage switch B to CWS.

R (30) Rotate F/O control wheel clockwise approximately 45
R degrees.

R RESULT:

R AP engage switch B remains in CWS.

R Maintain control wheel position.

R (31) Depress TURB switchlight to on.

R RESULT:

R Force required to hold control wheel at existing
R position increases.

R (32) Release control wheel force.

R RESULT:

R AP engage switch B may drop to OFF.

R (33) Set AP engage switch B to OFF.

R 4. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 4B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 4B.

R Since no fault isolation system can cover every potential fault, references to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R Turbulence Mode Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
3B(2)-1	AP engage switch A cannot be raised to CWS	(1)
3B(2)-2	AP engage switch will not hold in CWS	(2)
3B(2)-3	Control column or wheel position changes	(3)
3B(2)-4	AP LIMIT message displayed	(4)
3B(3)-1	ADI FD flag in view	(5)
3B(3)-2	ADI FD command bar position incorrect	(6)
3B(4)-1	TURB switchlight not illuminated	(7)
3B(4)-2	Capt AFCS MODES annunciator TURB message not displayed	(8)
3B(4)-3	F/O AFCS MODES annunciator TURB message not displayed	(9)
3B(4)-4	Capt ADI FD flag displayed	(10)
3B(4)-5	F/O ADI FD flag displayed	(11)
3B(4)-6	Capt ADI command bar in view	(12)
3B(4)-7	F/O ADI command bar in view	(13)

Turbulence Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
3B(5)-1	AP DISC message or flashing ALERT light not displayed	(14)
3B(5)-2	Capt AFCS MODES annunciator TURB message not removed	(15)
3B(5)-3	F/O APFDS MODES annunciator TURB message not removed	(16)
3B(5)-4	Capt ADI command bar not in view	(17)
3B(5)-5	F/O ADI command bar not in view	(18)
3B(6)-1	VS message not displayed	(19)
3B(6)-2	VS message not displayed	(20)
3B(6)-3	FD flag in view	(21)
3B(6)-4	Command bar not centered and level	(22)
3B(7)-1	HDG switchlight not illuminated	(23)
3B(7)-2	HDG SEL message not displayed	(24)
3B(7)-3	FD flag in view	(25)
3B(7)-4	Command bar not centered and level	(26)
3B(8)-1	AP engage switch A cannot be set to CMD	(27)
3B(8)-2	AP DISC message or flashing ALERT light display not removed	(28)
3B(9)-1	AP engage switch A does not drop to CWS	(29)
3B(9)-2	On Capt AFCS MODES annunciator, VS message not removed	(30)
3B(9)-3	On Capt AFCS MODES annunciator, HDG SEL message not removed	(31)
3B(9)-4	On F/O AFCS MODES annunciator, VS message not removed	(32)

Turbulence Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
3B(9)-5	On F/O AFCS MODES annunciator, HDG SEL message not removed	(33)
3B(11)-1	On Capt AFCS MODES annunciator, TURB message not removed	(34)
3B(11)-2	On F/O AFCS MODES annunciator, TURB message not removed	(35)
3B(12)-1	AP engage switch A drops to OFF	(36)
3B(12)-2	AP LIMIT message displayed	(37)
3B(13)	Control wheel force does not increase	(38)
3B(16)	AP engage switch A drops to OFF	(39)
3B(17)	Control wheel force does not increase	(40)
3B(21)-1	AP engage switch B cannot be raised to CWS	(41)
3B(21)-2	AP engage switch B will not hold in CWS	(42)
3B(21)-3	Control column or wheel position changes	(43)
3B(21)-4	AP LIMIT message displayed	(44)
3B(21)-5	AP DISC message or flashing ALERT light display not removed	(45)
3B(22)-1	AP engage switch B cannot be set to CMD	(46)
3B(22)-2	AP DISC message or flashing ALERT light display not removed	(47)
3B(23)	AP engage switch B does not drop to CWS	(48)
3B(25)-1	AP engage switch B drops to OFF	(49)
3B(25)-2	AP LIMIT message displayed	(50)
3B(26)	Control wheel force does not increase	(51)

Turbulence Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
3B(28)-1	AP DISC message is flashing ALERT light not displayed	(52)
3B(28)-2	Capt AFCS MODES annunciator TURB message not removed	(53)
3B(28)-3	F/O AFCS MODES annunciator TURB message not removed	(54)
3B(30)	AP engage switch B drops to OFF	(55)
3B(31)	Control wheel force does not increase	(56)

Schematics for Fault Isolation of Turbulence Mode Problem
Table 502

TITLE	LOCATION
Pitch System No. 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5
Pitch System No. 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
FD Mode Engage Logic Schematic	22-11-00, Schem 8
Turbulence, Vertical Speed, Indicated Airspeed, and Mach Hold Engage Logic Schematic	22-11-00, Schem 13
Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic	22-13-00, Schem 4
A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7

R B. Turbulence Mode Faults

R (1) Fault: AP engage switch A cannot be raised to CWS

R (a) Perform fault isolation procedure in 22-10-33 for
R Fault (4).

R ---

R (2) Fault: AP engage switch A will not hold in CWS

R (a) Perform fault isolation procedure in 22-10-33 for
R Fault (5).

R ---

R (3) Fault: Control column or wheel position changes

R (a) Perform tests specified in 22-10-33.

R ---

R (4) Fault: AP LIMIT message displayed

R (a) Perform autopilot A CWS/CMD mode tests specified
R in 22-10-33.

R ---

R (5) Fault: ADI FD flag in view

R (a) Perform FD basic mode tests specified in
R 22-10-31).

R ---

R (6) Fault: ADI FD command bar position incorrect

R (a) Perform FD basic mode tests specified in 22-10-31.

R ---

R (7) Fault: TURB switchlight not illuminated

R (a) Can lamp test procedure (Ref. 22-02-01) be
R performed with no indicated fault?

R Yes: Replace APFDS ENGAGE panel (Ref. 22-10-01).

R No: Perform lamp fault isolation procedures (Ref.
R 22-02-01).

R ---

R (8) Fault: Capt AFCS MODES annunciator TURB message not displayed.

R (a) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated TURB message fault?

R Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, replace Capt. AFCS MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (9) Fault: F/O AFCS MODES annunciator TURB message not displayed.

R (a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated TURB message fault?

R Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (10) Fault: Capt ADI FD flag displayed

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (11) Fault: F/O ADI FD flag displayed

R (a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (12) Fault: Capt ADI command bar in view

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (13) Fault: F/O ADI command bar in view

R (a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (14) Fault: AP DISC message or flashing ALERT light not displayed?

R (a) Perform mode annunciation press-to-test procedure (Ref. 22-02-01).

R ---

R (15) Fault: Capt AFCS MODES annunciator TURB message not removed

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (16) Fault: F/O APFDS MODES annunciator TURB message not removed

R (a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (17) Fault: Capt ADI command bar not in view

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (18) Fault: F/O ADI command bar not in view

R (a) Replace pitch computer No. 2 (Ref. 22-11-01).

R ---

R (19) Fault: VS switchlight not illuminated

R (a) Perform FD vertical speed mode test (Ref. 22-11-31).

R ---

R (20) Fault: VS message not displayed

R (a) Perform FD vertical speed mode test (Ref. 22-11-31).

R ---

R (21) Fault: FD flag in view

R (a) Perform FD vertical speed mode test (Ref. 22-11-31).

R ---

R (22) Fault: Command bar not centered and level

R (a) Perform FD vertical speed mode test (Ref. 22-11-31).

R ---

R (23) Fault: HDG switchlight not illuminated

R (a) Perform FD heading select mode test (Ref. 22-13-31).

R ---

R (24) Fault: HDG SEL message not displayed

R (a) Perform FD heading select mode test (Ref. 22-13-31).

R ---

R (25) Fault: FD flag in view

R (a) Perform FD heading select mode test (Ref. 22-13-31).

R ---

R (26) Fault: Command bar not centered and level

R (a) Perform FD heading select mode test (Ref. 22-13-31).

R ---

R (27) Fault: AP engage switch A cannot be set to CMD

R (a) Replace pitch computer No. 1 (Ref. 22-11-01). Repeat test. Can switch be raised to CMD?

R Yes: Fault condition in original computer.

R No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

R ---

R (28) Fault: AP DISC message or flashing ALERT light display
R not removed

R (a) Perform autopilot A CWS/CMD mode test (Ref.
R 22-10-33).

R ---

R (29) Fault: AP engage switch A does not drop to CWS

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).
R Repeat test. Does switch drop to CWS?

R Yes: Fault condition in original computer.

R No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

R ---

R (30) Fault: On Capt AFCS MODES annunciator, VS message not
R removed

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (31) Fault: On Capt AFCS MODES annunciator, HDG SEL message
R not removed

R (a) Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (32) Fault: On F/O AFCS MODES annunciator, VS message not
R removed

R (a) Replace pitch computer No. 1 (Ref. 22-11-01).

R ---

R (33) Fault: On F/O AFCS MODES annunciator, HDG SEL message
R not removed

R (a) Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (34) Fault: On Capt AFCS MODES annunciator, TURB message not removed

R (a) Replace pitch computer No. 1 (Ref. 22-11-01). Repeat test. Is TURB message removed?

R Yes: Fault condition in original computer.

R No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

R ---

R (35) Fault: On F/O AFCS MODES annunciator, TURB message not removed

R (a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Is TURB message removed?

R Yes: Fault condition in original computer.

R No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

R ---

R (36) Fault: AP engage switch A drops to OFF

R (a) Perform autopilot A CWS/CMD mode test (Ref. 22-10-33).

R ---

R (37) Fault: AP LIMIT message displayed

R (a) Perform autopilot A CWS/CMD mode test (Ref. 22-10-33).

R ---

R (38) Fault: Control wheel force does not increase

R (a) Can autopilot A CWS/CMD mode test (Ref. 22-10-33) be performed with no indicated fault?

R Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

R No: Perform autopilot A CWS/CMD mode fault isolation procedures (Ref. 22-11-33).

R ---

R (39) Fault: AP engage switch A drops to OFF

R (a) Perform autopilot A CWS/CMD mode test (Ref. R 22-10-33).

R ---

R (40) Fault: Control wheel force does not increase

R (a) Can autopilot A CWS/CMD mode test (Ref. 22-10-33) R be performed with no indicated faults?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).

R No: Perform autopilot A CWS/CMD mode fault R isolation procedures (Ref. 22-11-33).

R ---

R (41) Fault: AP engage switch B cannot be raised to CWS

R (a) Perform fault isolation procedure in 22-10-35 for R Fault (4).

R ---

R (42) Fault: AP engage switch B will not hold in CWS

R (a) Perform autopilot B CWS/CMD mode test (Ref. R 22-10-35).

R ---

R (43) Fault: Control column or wheel position changes

R (a) Perform autopilot B CWS/CMD mode test (Ref. R 22-10-35).

R ---

R (44) Fault: AP LIMIT message displayed

R (a) Perform autopilot B CWS/CMD mode test (Ref. R 22-10-35).

R ---

R (45) Fault: AP DISC message or flashing ALERT light display R not removed

(a) Perform autopilot B CWS/CMD mode test (Ref. 22-10-35).

---

(46) Fault: AP engage switch B cannot be set to CMD

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Can switch be raised to CMD?

Yes: Fault condition in original computer.

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(47) Fault: AP DISC message or flashing ALERT light display not removed

(a) Perform autopilot B CWS/CMD mode test (Ref. 22-10-35).

---

(48) Fault: AP engage switch B does not drop to CWS

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Does switch drop to CWS?

Yes: Fault condition in original computer.

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(49) Fault: AP engage switch B drops to OFF

R (a) Perform autopilot B CWS/CMD mode test (Ref.
R 22-10-35).

---

(50) Fault: AP LIMIT message displayed

(a) Perform autopilot B CWS/CMD mode test (Ref. 22-10-35).

---

(51) Fault: Control wheel force does not increase

(a) Can autopilot B CWS/CMD mode test (Ref. 22-10-35) be performed with no indicated fault?

Yes: Replace pitch computor No. 2 (Ref. 22-11-01).

No: Perform fault isolation procedure for
R autopilot B CWS/CMD mode (Ref. 22-10-35).

---

(52) Fault: AP DISC message is flashing ALERT light not displayed

(a) Perform mode annunciation press-to-test (Ref. 22-02-01).

---

(53) Fault: Capt APFDS MODES annunciator TURB message not removed

(a) Replace pitch computer No. 1 (Ref. 22-11-01).

---

(54) Fault: F/O AFCS MODES annunciator TURB message not displayed

(a) Replace pitch computers No. 2 (Ref. 22-11-01).

---

(55) Fault: AP engage switch B drops to OFF

(a) Perform autopilot B CWS/CMD mode test (Ref. 22-10-35).

---

(56) Fault: Control wheel force does not increase

(a) Can autopilot B CWS/CMD mode test (Ref. 22-10-35) be performed with no indicated faults?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Perform fault isolation for autopilot B CWS/CMD mode (Ref. 22-10-35).

APFDS MODES OF OPERATION - DESCRIPTION AND OPERATION

1. General

The APFDS modes of operation section integrates the description of takeoff, cruise, approach, AUTOLAND and go-around modes. It describes the common pitch and roll axis operation plus interfacing operation with other AFCS systems. The various AFCS systems are described in the following sections:

22-11-00 Autopilot - Flight Director Pitch System

22-13-00 Autopilot - Flight Director Roll System

22-15-00 Yaw Stability Augmentation System

22-17-00 Stall Warning System

22-17-00 Altitude Alert System

22-17-00 Primary Flight Control Monitor System

22-17-00 Direct Lift Control/Automatic Ground Speed Brake System

22-18-00 Manual and Automatic Pitch Trim System

22-21-00 Mach Trim and Feel System

22-31-00 Speed Control System

Table 1 shows the different autopilot/flight director command mode engagement combinations.

A. Autopilot Flight Director System (APFDS)

The autopilot flight director system (APFDS) is an integrated system which provides pitch and roll axis autopilot and flight director commands. Two identical pitch computers and two identical roll computers provide dual-autopilot and dual-flight director systems. Controls for the integrated flight modes, autopilot engagements, and flight director engagements are provided on control panels mounted on the glareshield.

During cruise operation, only one of the autopilots can be engaged. Both autopilots can be simultaneously engaged for the AUTOLAND mode only. The autopilots are adapted to the modes in operation, system engagement configuration, and navigational and flight control data to derive the commands

AUTOPILOT ENGAGEMENT STATUS	FLIGHT DIRECTOR ENGAGEMENT STATUS	SELECTED COMMAND MODE	RESULT
OFF	OFF	Will not engage	ADI command bars out-of-view
OFF	ON	None	When FD is turned ON, ADI command bars sync to heading (if less than 3° bank) or to roll attitude (if more than 3° bank) and to pitch attitude. Provide commands to maintain heading/roll attitudes and pitch attitude for manual flight control. Command bars must be manually synced to any new attitude once it is established
OFF	ON	Takeoff or Go-around	ADI command bars provide commands to maintain wings level roll attitude and optimum pitch attitude for climb-out maneuver for manual flight control. Pitch commands are provided by the Speed Control System (SCS). HDG SELECT mode may be used
OFF	ON	Any Other, except TURB	ADI command bars provide manual control to computed guidance signal
CWS or CMD (basic)	OFF	None	ADI command bars out-of-view. When CWS is engaged, A/P will maintain existing heading (if less than 3° bank) or roll attitude (if more than 3° bank) and pitch attitude. When force is exerted on control wheel to change roll and/or pitch attitude, A/P will roll/pitch aircraft. When desired roll/pitch attitude is attained and control wheel force is relaxed, A/P will maintain the new attitude. During application of pitch CWS forces, pitch autotrim is inhibited and manual electric trim is enabled.
CWS or CMD	ON	None	A/P will control aircraft as described above. ADI command bars provide commands to maintain pitch attitude, ADI roll commands will always be wings level unless they are manually synced

M1-0100-22-383

Autopilot - Flight Director Command Mode Engagement Combination Table
Table 1 (Sheet 1)

AUTOPILOT ENGAGEMENT STATUS	FLIGHT DIRECTOR ENGAGEMENT STATUS	SELECTED COMMAND MODE	RESULT
CWS	ON	Takeoff or Go-around	A/P provides heading/roll and pitch attitude hold with control wheel steering. ADI command bars provide roll attitude wings level commands, and optimum pitch commands for climb-out. Pitch commands are provided by the Speed Control System (SCS). HDG SELECT may be used
CMD	ON	Go-around (Flaps must be extended more than 30°)	A/P maintains wings level roll attitude and controls pitch attitude to establish optimum climb-out. ADI command bars provide roll and pitch commands for the same may be used to monitor A/P operation. Pitch commands are provided by the Speed Control System (SCS). HDG SELECT may be used
CWS or CMD	ON	Altitude hold	A/P provides heading/roll hold with control wheel steering, and provides automatic pitch control to maintain selected altitude. ADI command bars will provide wings level or roll attitude commands, and pitch commands to maintain selected altitude (the latter can be used to monitor A/P operation)
CWS or CMD	ON or OFF	Turbulence (Not in A/L Track; Not in Go-around). Any other mode (s) disengage when TURB is selected, and cannot be re-engaged until TURB is disengaged	If FD is ON, ADI command bars will bias out-of-view. If A/P is in CMD, it will revert to CWS. A/P will provide heading/roll attitude and pitch attitude hold as described above (Basic), however, A/P control gains are reduced for softer control. The force necessary to move the control wheel column is approximately double that of the Basic mode. Turbulence mode can only be engaged when the autopilot is engaged
CWS	ON	Any other	A/P provides heading/roll attitude and pitch attitude hold will control wheel steering (basic). ADI command bars provide commands to maintain computed flight path relative to mode (s) engaged

M1–0100–22–384

Autopilot - Flight Director Command Mode Engagement Combination Table
Table 1 (Sheet 2)

AUTOPILOT ENGAGEMENT STATUS	FLIGHT DIRECTOR ENGAGEMENT STATUS	SELECTED COMMAND MODE	RESULT
CMD	OFF	Any (2)	ADI command bars out-of-view. A/P controls aircraft in response to computed guidance signals relative to the mode (s) engaged
CMD	ON	Any (2)	A/P controls aircraft as described immediately above. ADI command bars may be used to monitor A/P operation
Engagement of the takeoff mode or turbulence mode causes automatic reversion of the autopilot to its basic mode of operation (CWS)			

M1-0100-22-387

Autopilot - Flight Director Command Mode Engagement
Combination Table
Table 1 (Sheet 3)

necessary to position the stabilizer and inboard ailerons relative to the desired attitude. The autopilots in pitch axis provide commands which control their respective channels in the stabilizer dual autopilot servo (Ref. 22-11-00). The servo, in turn, controls the stabilizer servos to position the stabilizer. The autopilots in roll axis provide commands which control respective channels in the dual left inboard aileron servo (Ref. 27-11-00). The servo displaces the inboard ailerons in response to the commands.

R The flight directors, either or both, can be selected during any operating mode independent of the autopilots. The
R flight director, with the autopilot disengaged, provides the
R pitch and roll axis guidance command displays with manual
R control. The flight director command bars, depending on
R selected mode, displays autopilot performance when the autopilot is engaged. The display is provided on the attitude director indicators (Ref. 34-21-00).

Each autopilot is capable of performing two identical computations which allows the system to perform a maximum of four independent but identical computations. The computing channels consist of voters which compare all computations to provide compatible command outputs to the autopilot servo channels.

The APFDS consists of the following components (Ref. Fig. 1):

Pitch computers No. 1 and No. 2, forward electronic service center, center rack, zone 112

Roll computers No. 1 and No. 2, forward electronic service center, center rack, zone 112

APFDS ENGAGE panel, glareshield panel, zone 210

NAV MODE select panel, glareshield panel, zone 210

HEADING/PITCH MODE command panel, glareshield panel, zone 210

ALT SELECT panel, glareshield panel, zone 210

AFCS MODES annunciator indicators, pilots instrument panels, zones 211 and 212

AFCS WARNING indicators, pilots instrument panels, zones 211 and 212

Autopilot disengage switches, pilots control wheel outboard horns, zones 211 and 212

Takeoff/go-around select switches, pilots control wheel outboard horns, zones 211 and 212

DUAL A/L NOT AVAIL master caution indicator, pilots center instrument panel, zone 210

Normal accelerometer unit, above galley ceiling, zone 135

Lateral accelerometer unit, above galley ceiling, zone 135

Left inboard aileron dual position transducers, left inboard aileron rear spar area, zone 551

Stabilizer autopilot control servo, lower section of afterbody

AFCS/MLG accessory unit, forward electronic service center center rack, zone 112

In addition to the APFDS components, the system interfaces with the speed control computer (Ref. 22-31-00) and FCES computer (Ref. 22-17-00). The speed control computer provides takeoff and go-around pitch command computations for the APFDS. The FCES computer controls the altitude select function and fault isolation monitoring.

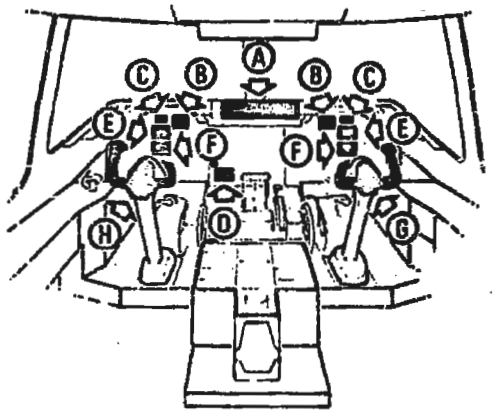
The interface between the APFDS components, speed control and FCES computers, and the associated navigation and flight control equipment required for APFDS operation is shown in Figures 2 and 3.

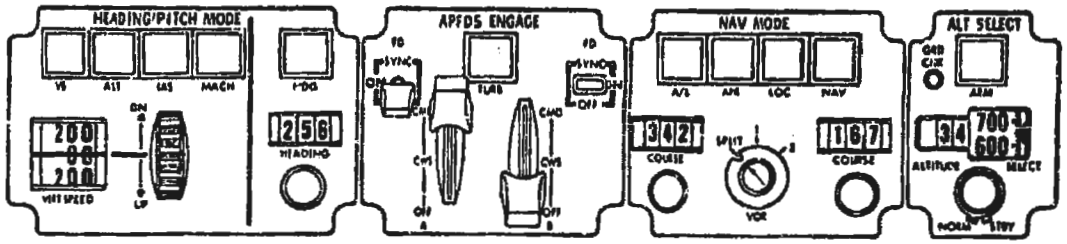
2. Operation

A. Power Application

The primary power to the APFDS is received from the essential and extension No. 2 ac buses, and dc essential, No. 2, and No. 3 buses (Ref. Fig. 4). The power is applied through circuit breakers provided on the pilots overhead circuit breaker panel CB1, zone 210, in the areas designated AVIONICS FLIGHT CONTROL SYSTEM and on the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215.

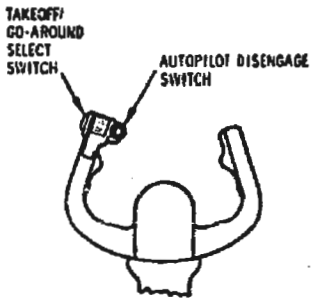
B. Operating Configurations



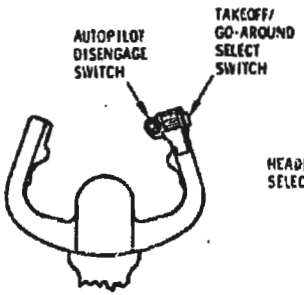


HEADING/PITCH MODE COMMAND PANEL | APFDS ENGAGE PANEL | NAVIGATION MODE SELECT PANEL | ALTITUDE SELECT PANEL

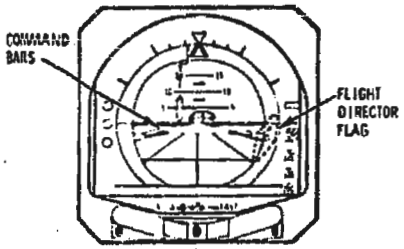
(A) GLARESHIELD PANEL



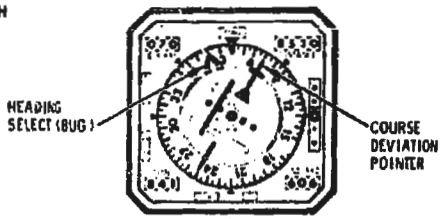
(H) CAPTAINS CONTROL WHEEL



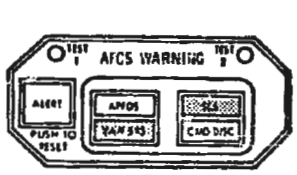
(G) FIRST OFFICERS CONTROL WHEEL



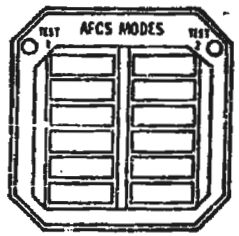
(E) ATTITUDE DIRECTOR INDICATOR (REF. 34-21-00)



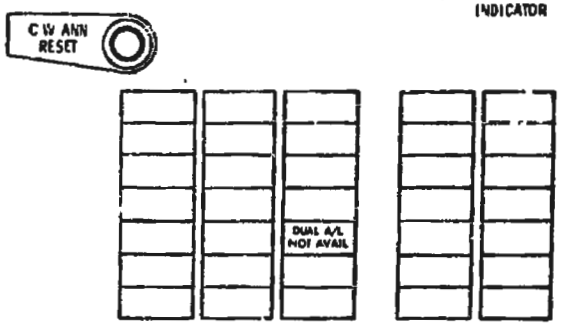
(F) HORIZONTAL SITUATION INDICATOR (REF. 34-55-00)



(C) AFCS WARNING INDICATOR



(B) AFCS MODES ANNUNCIATOR INDICATOR



(D) PILOTS CAUTION AND WARNING PANEL

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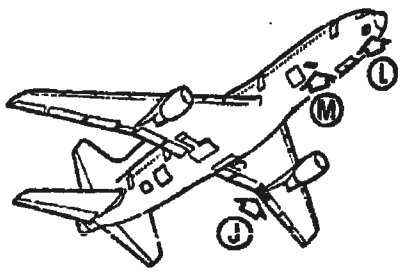
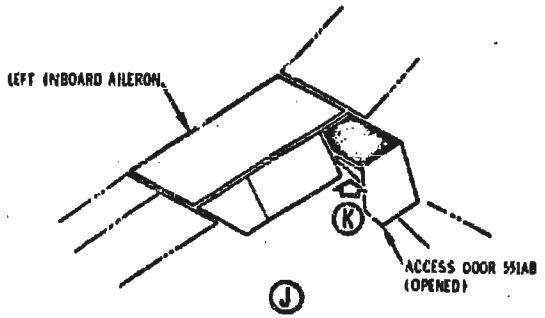
M1-5002-22-046

R APFDS Equipment and Location
R Figure 1 (Sheet 1)

R EFFECTIVITY: ALL
R
0508





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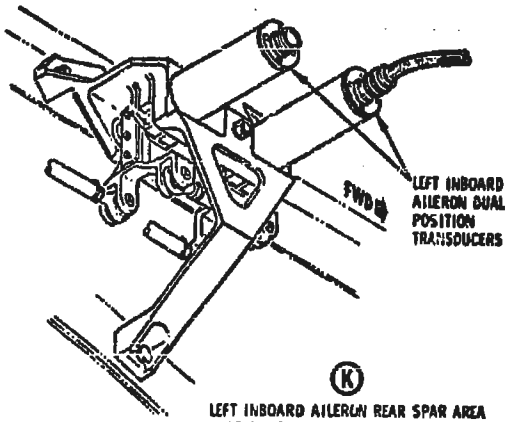
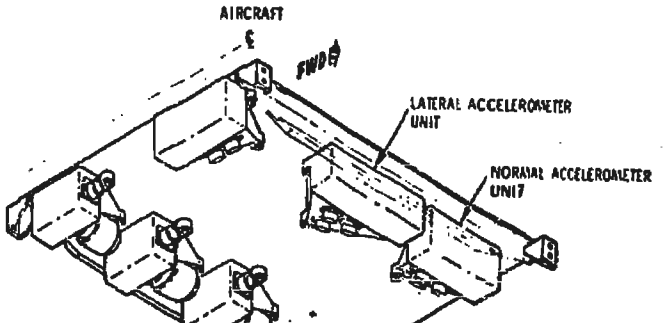
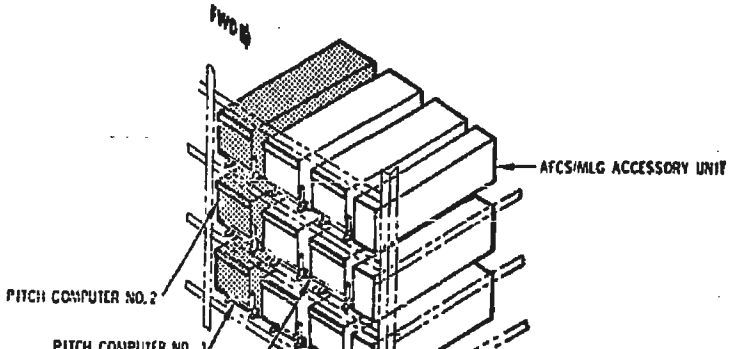


K
LEFT INBOARD AILERON REAR SPAR AREA
(LEFT INBOARD AILERON STATION 571)



M
ABOVE GALLEY CEILING
(LOOKING UP)



L
FORWARD ELECTRONIC SERVICE CENTER
CENTER RACK

G 746
M1-0102-22-080

R
R
APFDS Equipment and Location
Figure 1 (Sheet 2)

R
R
EFFECTIVITY: ALL

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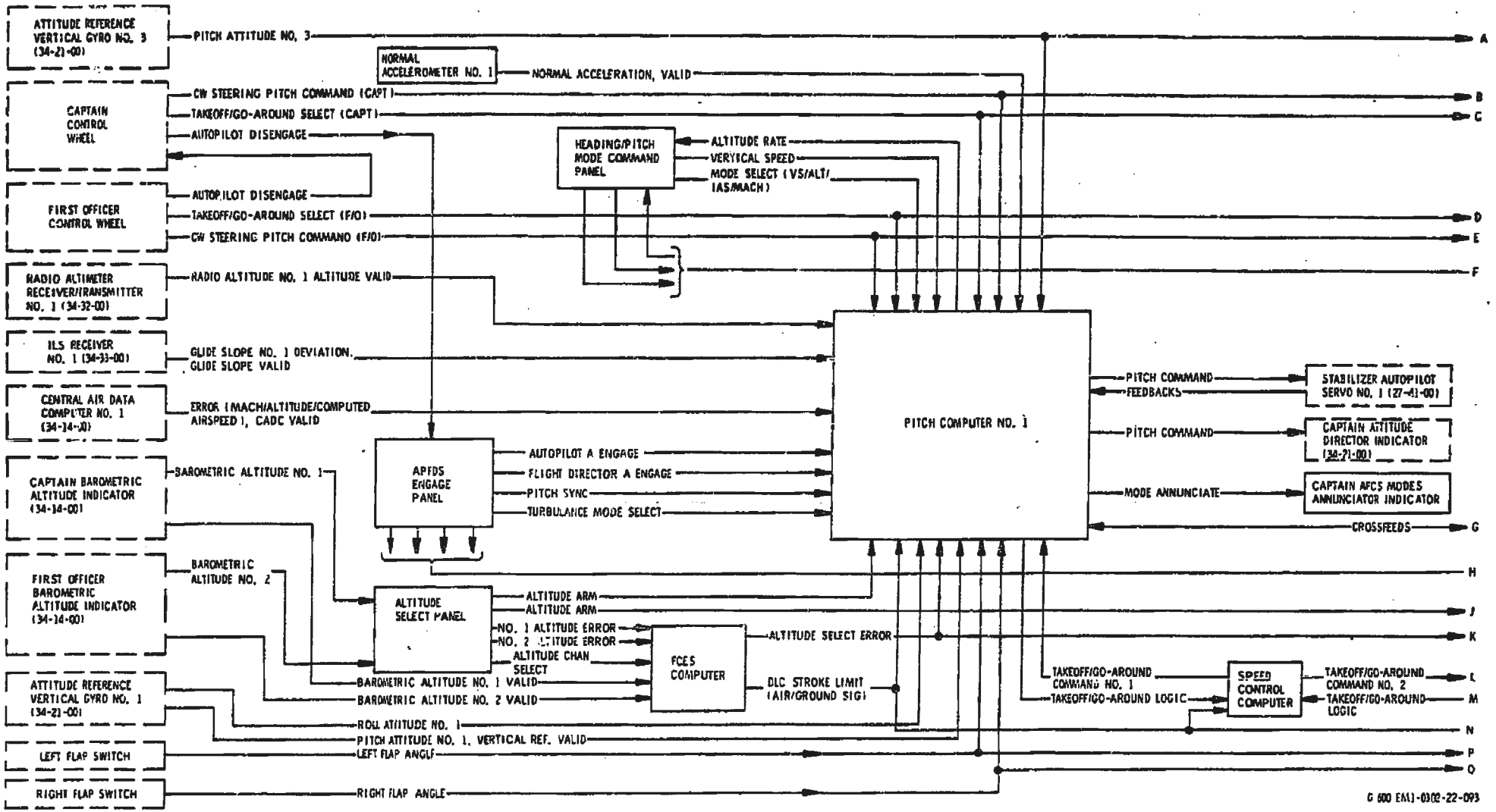
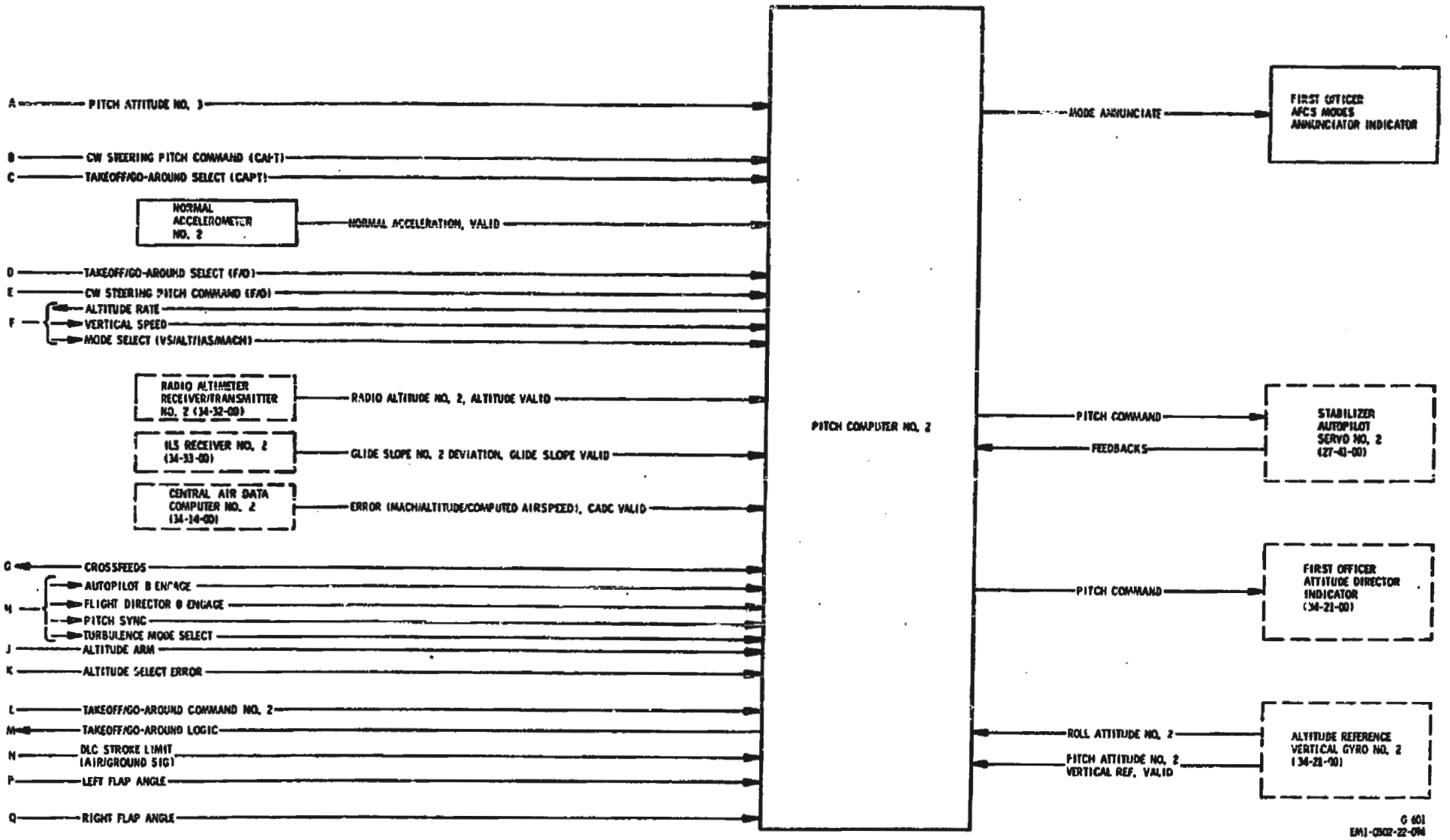


APFDS Pitch Channel Interface Block Diagram
Figure 2 (Sheet 1)



R APFDS Pitch Channel Interface Block Diagram
R Figure 2 (Sheet 2)

R EFFECTIVITY: ALL
R
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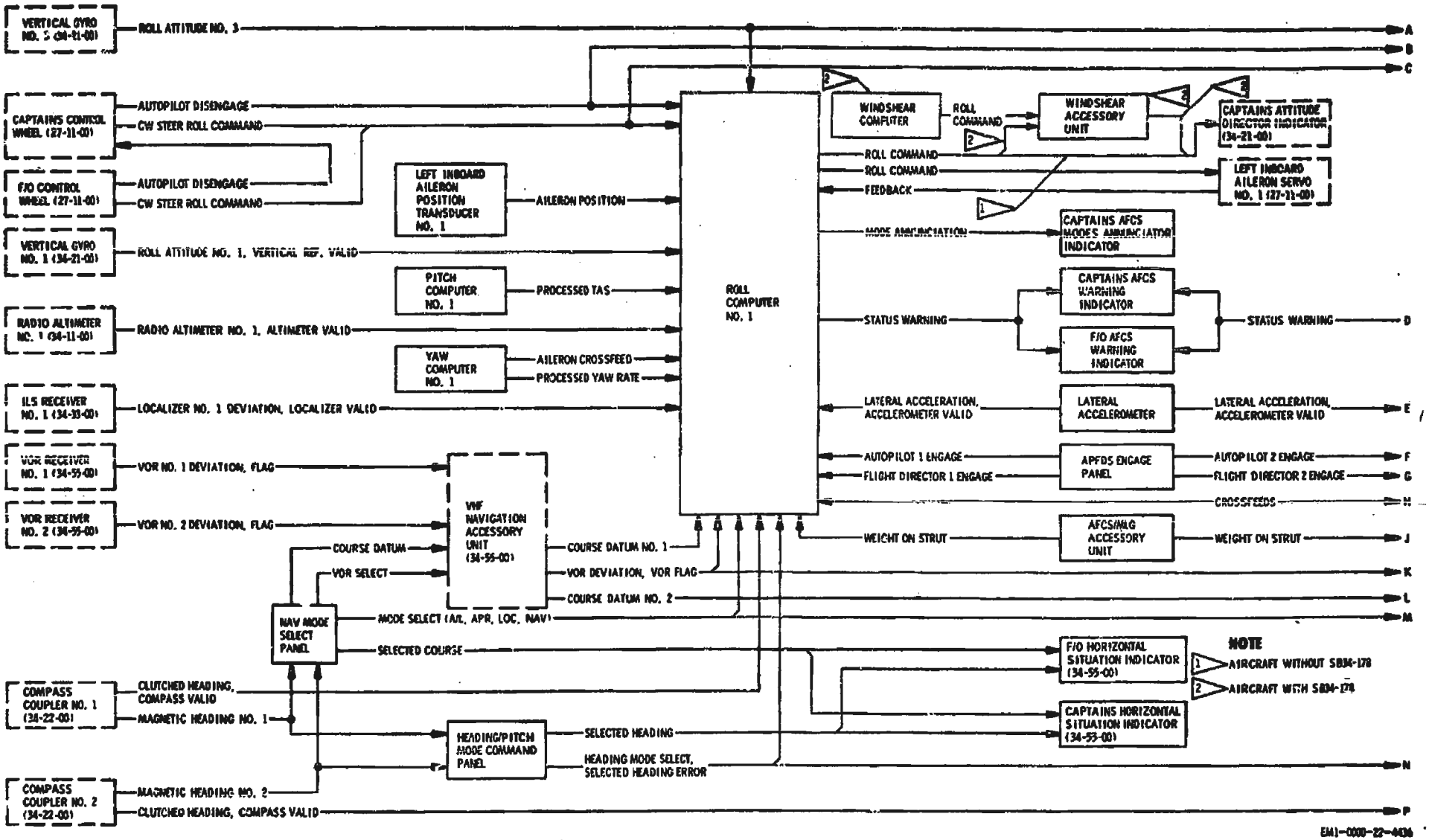

R APFDS Roll Channel Interface Block Diagram
R Figure 3 (Sheet 1)

EFFECTIVITY: ALL

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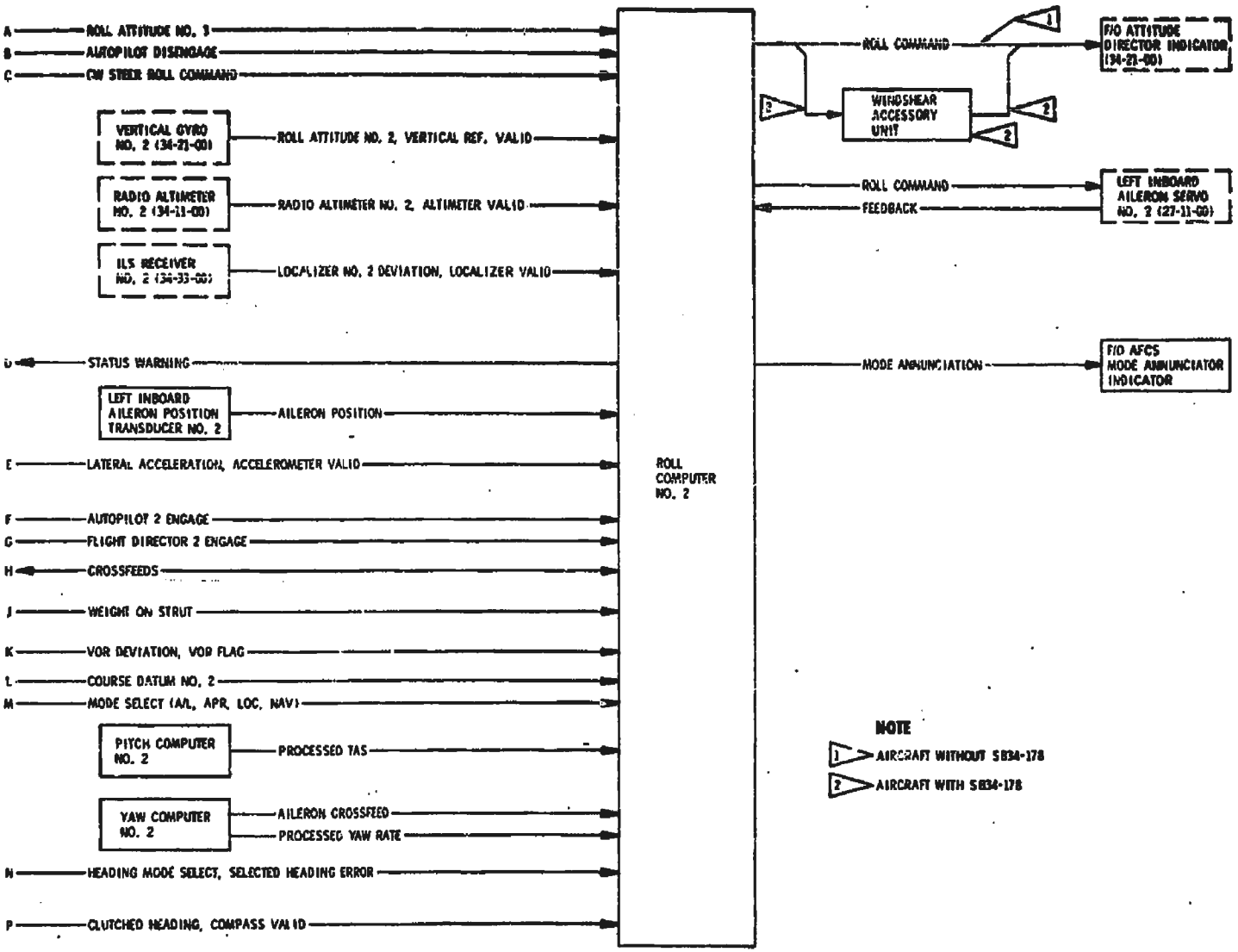
A ROLL ATTITUDE NO. 1
B AUTOPILOT DISENGAGE
C CW STEER ROLL COMMAND
VERTICAL GYRO NO. 2 (34-21-00)
ROLL ATTITUDE NO. 2, VERTICAL REF. VALID
RADIO ALTIMETER NO. 2 (34-11-00)
RADIO ALTIMETER NO. 2, ALTIMETER VALID
ILS RECEIVER NO. 2 (34-33-00)
LOCALIZER NO. 2 DEVIATION, LOCALIZER VALID
D STATUS WARNING
LEFT INBOARD AILERON POSITION TRANSDUCER NO. 2
AILERON POSITION
E LATERAL ACCELERATION, ACCELEROMETER VALID
F AUTOPILOT 2 ENGAGE
G FLIGHT DIRECTOR 2 ENGAGE
H CROSSFEEDS
J WEIGHT ON STRUT
K VOR DEVIATION, VOR FLAG
L COURSE DATUM NO. 2
M MODE SELECT (A/L, APR, LOC, NAV)
PITCH COMPUTER NO. 2
PROCESSED TAS
YAW COMPUTER NO. 2
AILERON CROSSFEED
PROCESSED YAW RATE
N HEADING MODE SELECT, SELECTED HEADING ERROR
P CLUTCHED HEADING, COMPASS VALID
ROLL COMPUTER NO. 2
ROLL COMMAND
F/O ATTITUDE DIRECTOR INDICATOR (34-21-00)
WINDSHEAR ACCESSORY UNIT
ROLL COMMAND
FEEDBACK
LEFT INBOARD AILERON SERVO NO. 2 (27-11-00)
MODE ANNUNCIATION
F/O AFCS MODE ANNUNCIATOR INDICATOR
NOTE
1 AIRCRAFT WITHOUT SB34-178
2 AIRCRAFT WITH SB34-178

EM1-0000-22-4437

R APFDS Roll Channel Interface Block Diagram
R Figure 3 (Sheet 2)

EFFECTIVITY: ALL

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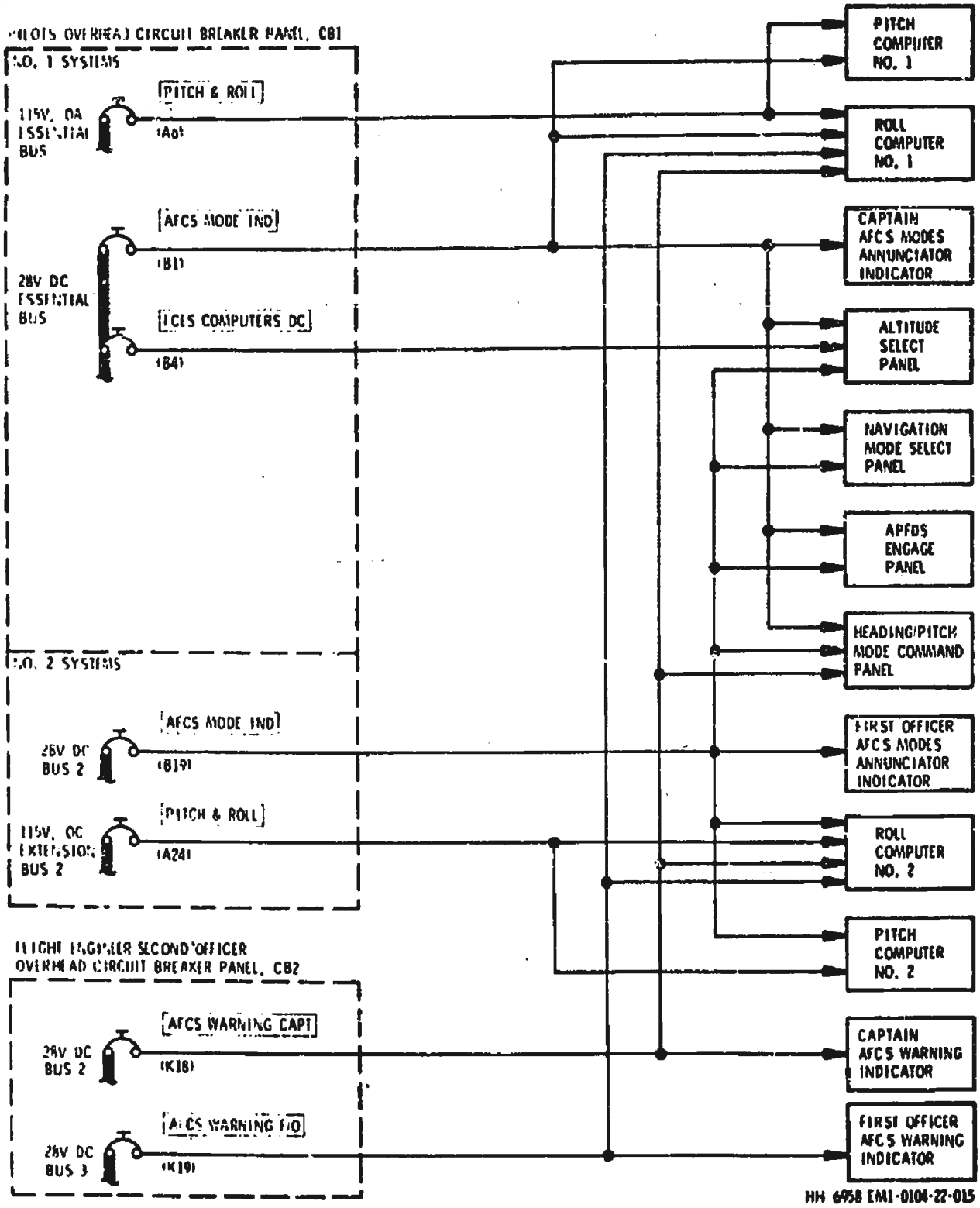


R R APFDS Primary Power Distribution Diagram
Figure 4

R EFFECTIVITY: ALL

The extent of aircraft control provided by the APFDS depends on the engagement status of the autopilot and flight director and the mode of operation selected. The APFDS autopilot can be engaged to provide a basic or command mode of operation.

(1) Basic Configuration

The basic configuration is selected by setting either autopilot engage switch to CWS. The basic configuration provides attitude hold with control wheel steering capability. Upon initial engagement, the existing attitude is maintained. A new attitude reference may be established by applying force to the control wheel, flying to a new attitude, and releasing the control wheel. In the basis configuration, the aircraft can be controlled with control wheel steering to follow a flight path selected by the flight director displays.

(2) Command Configurations

The command configuration is selected by setting either autopilot engage switch to CMD. The command configuration provides the capability for automatic control to the selected flight path mode. If a flight path mode is already selected on a flight director at the time of the command engagement, the autopilot follows the existing flight path command. The command engagement with no flight path mode selected results in basic configuration operation.

(a) Cruise Configuration

During the command cruise configuration, each autopilot is capable of one cruise computation. Only one autopilot at a time can be engaged, however, both autopilot computations are continuously active. A failure detected in the engaged autopilot results in automatic disengagement of that autopilot or trips the autopilot to CWS. After complete disengagement of the first autopilot, the second autopilot can be engaged.

(b) Approach Configuration

The approach configuration is used to automatically steer the aircraft to the Category I land/go-around decision height. In the approach configuration the autopilot is in a fail-soft status.

(c) AUTOLAND Configuration

The AUTOLAND configuration of the autopilot automatically directs the aircraft through the glideslope and localizer to landing. This function is normally performed with both autopilots engaged simultaneously. The autopilot is in a fail-operational status in which four isolated but identical computations are performed to generate stabilizer autopilot servo and left inboard aileron servo command signals. Before being transmitted as servo commands, the computed outputs are failure-monitored by comparators and fed through quad voters that select the best of the computed signals for command outputs. The use of comparators and voters for computation outputs minimizes the frequency of nuisance disconnects due to transients. The fail-operational status is such that the first failure does not result in degradation of performance, however, the autopilot changes to the fail-passive status. The second failure causes the autopilot either to disengage automatically or to go into the basic configuration.

The AUTOLAND configuration can be performed with only one autopilot engaged. In this case, the two computed outputs are fed through the low-level voters before being transmitted as command outputs. A single failure causes the autopilot to disengage automatically or to go into the basic configuration.

During AUTOLAND operation, the flight directors, if engaged, are used to monitor autopilot operation. If the autopilot is disengaged or is in the basic configuration with control wheel steering available, the flight director provides the capability for Category II approach.

(d) Go-around Configuration

During go-around, the pitch command is computed by the speed control computer. The roll command is a wings-level command signal provided by the roll channel. Go-around is available for either autopilot or flight director control.

C. Autopilot Engagement

The two autopilots are engaged separately using the autopilot engage switches A and B (OFF-CWS-CMD) on the APFDS

ENGAGE panel. The autopilot is engaged independent of the flight directors. Only one autopilot can be engaged at a time except during the AUTOLAND mode of operation, however, the computational channels of both autopilots are active. An autopilot engagement results in application of hydraulic power to the corresponding autopilot servo channel. The autopilot servo channel corresponding to the unengaged autopilot remains inactive.

With the switch (bat handle) in the CWS position, the autopilot is engaged in the basic configuration which provides heading/attitude hold control with control wheel steering capability. With the bat handl in the CMD position, the autopilot is in command configuration which provides the capability for automatic control to the selected flightpath command mode.

To engage the autopilot in the CWS configuration, the following requirements must be satisfied:

Other autopilot not engaged

Power supply monitors valid

Associated vertical gyro valid

Associated compass system valid

Associated pitch and roll computers valid

One yaw computer valid

One automatic trim channel valid

Normal accelerometer valid

Bat handle raised to CWS position

If all the requirements are satisfied, the CWS gate is opened and the bat handle is held in the CWS position until the status of the pitch autopilot servo and roll (left inboard aileron) servo is determined. After the bat handle is placed in the CWS position, the pitch autopilot servo actuator position must be synchronized to the existing trim position and the two servo monitors show valid outputs before a pitch servo engage piston is engaged. If the conditions are not satisfied, the servo engage piston does not engage and the CWS engage enable signal is removed, which releases the bat handle. If the pitch servo engage piston has engaged, and if the roll servo and roll servo hook engagement signals are valid, the bat handle remains engaged in the CWS position. Once the autopilot is engaged,

the pitch servo engage piston monitor signals the applicable computers that the autopilot is engaged.

When the bat handle is placed in the CMD position, the command gate in the pitch computer is opened and the command engage enable signal is applied to the bat handle holding solenoid. The bat handle remains in the CMD position if the following requirements are satisfied:

Autopilot engaged or engageable in CWS configuration

Command enable signal valid

No mode release logic present to indicate a flight director fault

D. Flight Director Engagement

The two flight directors are engaged separately using the flight director (FD) switches on the APFDS ENGAGE panel. The flight directors can be engaged independent of the autopilot engagement. The left and right FD switches on the panel control the command bars on Captains and First Officers attitude director indicators (ADI), respectively.

If the FD switch is in the OFF position, the pitch and roll command bars on the associated ADI are held out of view. When the switch is placed in the ON position, the command bars appear and are positioned in response to command signals from the flight director. During manual aircraft control, the command bars move off center if the aircraft deviates from the guidance command computed by the flight director. The deviation is minimized using control wheel steering. When the autopilot is engaged the flight director is used to monitor the autopilot performance.

E. Mode Annunciation

The manually selected modes are indicated by the illumination of the mode select switchlights. In addition, the modes in which the APFDS is operating or armed as a result of manual or automatic engagement are remotely annunciated on the AFCS MODES annunciator indicators.

The annunciator drivers in the pitch and roll computers provide a ground for switchlight lamps and mode annunciator solenoids when mode engagements are established in the computers. The pitch computers activate the following annunciations on the AFCS MODES indicators:

GS	GS ARM
FLARE	FLR ARM

R on aircraft without SB34-178,

R GO-ARND VS

R on aircraft with SB34-178,

R TO/GA VS

ALT ALT ARM
IAS MACH

R on aircraft without SB34-178,

R TAKEOFF VS

R on aircraft with SB34-178,

R TO/GA VS

The roll computers activate the following annunciations on the AFCS MODES indicators:

A/L	A/L ARM
LOC	LOC ARM
VOR	VOR ARM
HDG SEL	R NAV

F. Pitch Axis Modes of Operation

(1) The following pitch modes of operation are described in 22-11-00:

Pitch Attitude Hold

Altitude Hold

Control Wheel Steering

Mach Hold

Indicated Airspeed Hold

Vertical Speed Hold

Altitude Select

G. Roll Axis Modes of Operation

(1) The following roll mode of operation are described in 22-13-00:

Wings Level

Heading Hold

Bank Hold

Control Wheel Steering

Heading Select

VOR Navigation

Localizer

H. Common Axis Modes of Operation

The common axis modes are those which cause the APFDS pitch and roll controls to function simultaneously when selected. All common axis modes are selectable on the flight station glareshield control panels. The following common axis modes are available:

Approach

AUTOLAND

Go-around

Takeoff

Turbulence

(1) Approach

The approach mode may be engaged with either autopilot in CMD, and/or at least one FD on. The approach mode is engaged by tuning at least one ILS receiver (Ref. 34-33-00) to a localizer frequency, setting in the runway heading, and depressing the APR switchlight on the NAV MODE select panel. The approach mode provides automatic capture and tracking of the glideslope and localizer beams. The lighted APR switchlight indicates that the approach mode is engaged. Upon APR mode engagement, the AFCS MODES annunciator indicators display LOC ARM and GS ARM modes which indicate that the localizer and glideslope capture functions in the roll and pitch channels are armed. The APR mode is automatically disengaged if a go-around is initiated.

(a) Roll Axis Approach

The first portion of the APR mode consists of capturing and tracking the selected localizer beam (Ref. Fig. 5). Capturing the localizer beam is

performed with the precapture guidance being either the roll attitude/heading hold or the heading select mode. Upon capturing the localizer beam, the precapture guidance mode is automatically disengaged. The command computation to capture and track the localizer beam is same as for the localizer (LOC) mode.

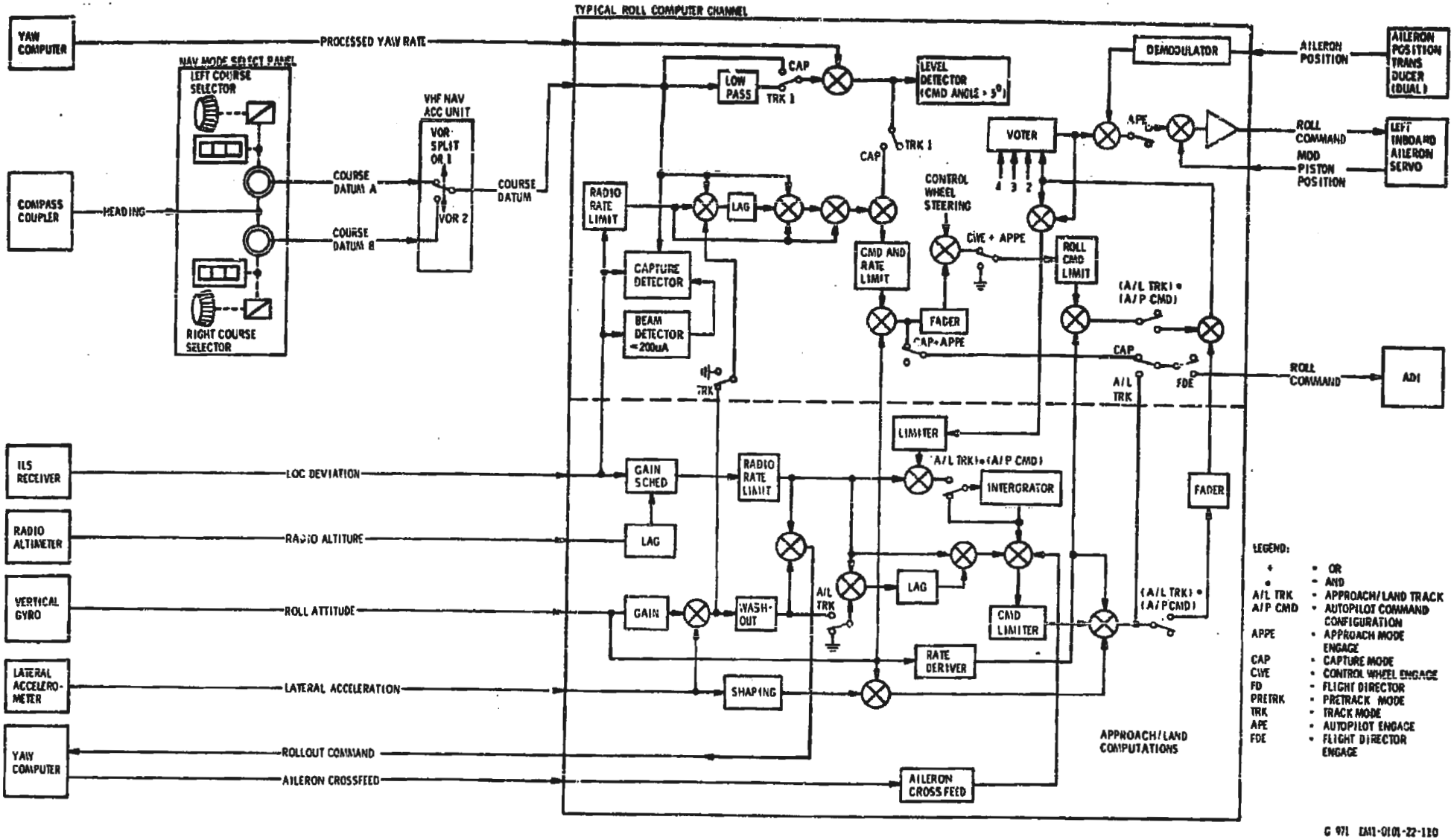
(b) Pitch Axis Approach

Glideslope beam capturing is performed by centering the aircraft on the localizer beam, flaps set for landing, and engine throttles adjusted for approach speed. Glideslope capturing can be performed in the pitch attitude hold, the vertical speed hold, or the altitude hold mode.

The basic control signals (Ref. Fig. 6) for the glide path mode consist of the glideslope error signal from the ILS receiver, instantaneous vertical velocity, and a bias signal. The instantaneous vertical velocity is the summation of a high-pass vertical acceleration signal from the normal accelerometer and a barometric altitude rate signal from the CADC. The resultant signal is then lagged before summed with an initial pitch-down bias signal.

The pitch computer receives the glideslope deviation signal from the ILS receiver. The signal is a function of the amount and direction of the aircraft displacement relative to the glide path beam center. The signal is limited by the pitch computer to produce a maximum pitch angle of 5 degrees.

The glide path may be intercepted from either above or below beam center. At the point of interception, the glideslope capture function is initiated, which allows an initial vertical speed command signal of 23 feet per second to enter the pitch computer where it is processed to effect an aircraft pitch attitude change. When the glideslope beam center is captured, the GS ARM mode changes to the GS mode on the AFCS MODES indicators. The aircraft is then put into a pitch attitude condition which enables the aircraft to track the glideslope beam. The aircraft continues to track the glideslope beam until it reaches the decision height. At this point, the pitch computer glideslope circuit is disabled as a function of the altitude signal from the radio



R Roll Axis Approach and AUTOLAND Modes
R Figure 5

EFFECTIVITY: ALL

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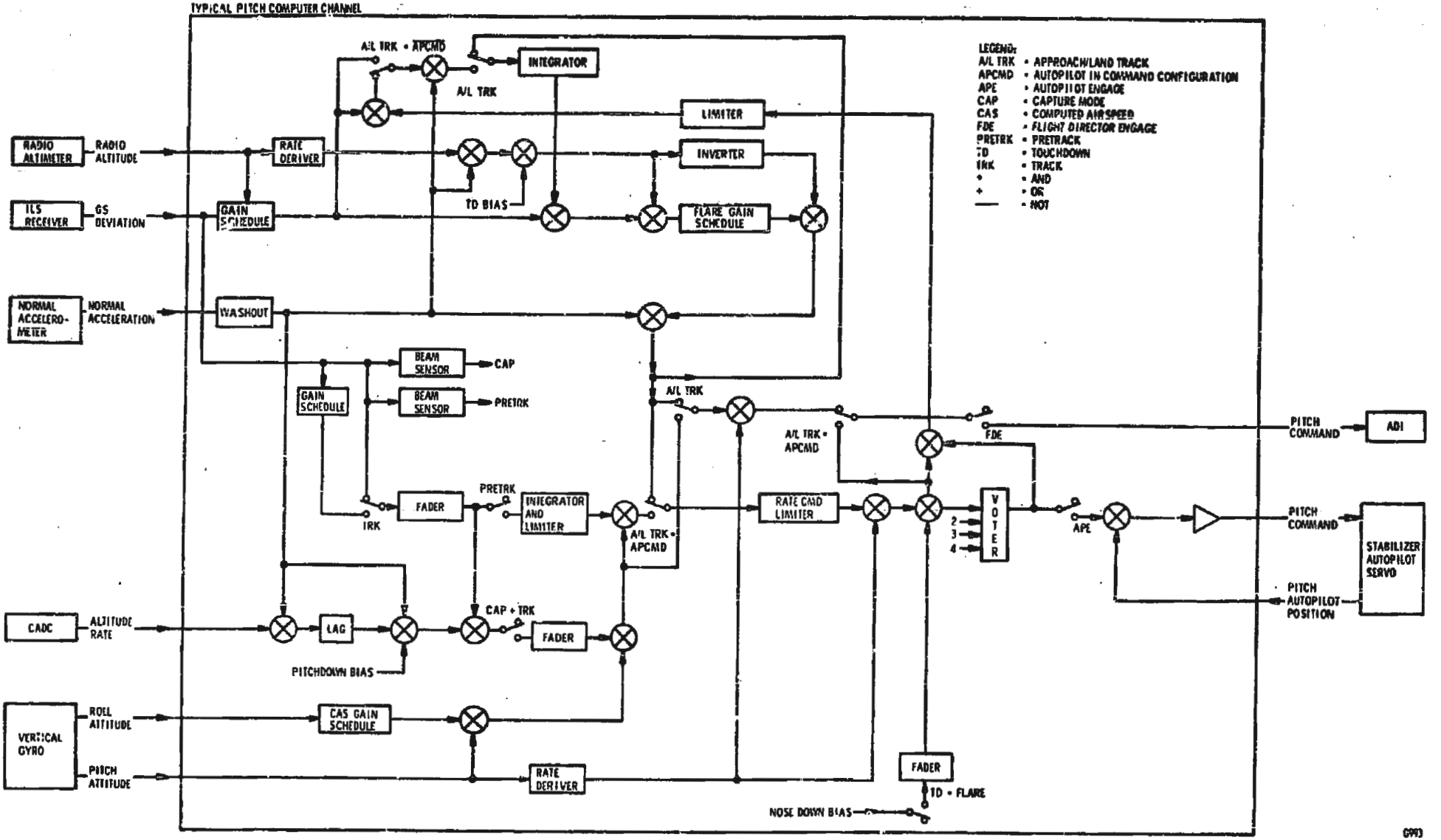

R
R Pitch Axis Approach and AUTOLAND Modes
Figure 6

EFFECTIVITY: ALL

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altimeter receiver/transmitter (Ref. 34-32-00), and a manual landing or go-around is executed.

(2) AUTOLAND

The AUTOLAND mode is selectable for autopilot in command (CMD) configuration and flight director control. The AUTOLAND mode is selected by tuning either or both ILS receivers to the runway localizer frequency, setting in the runway heading, and depressing the A/L switchlight on the NAV MODE select panel. The A/L mode arms if either or both flight directors are engaged and/or either autopilot is engaged in CMD configuration, and if the turbulence, VOR, go-around, takeoff, approach, IAS hold, or Mach hold mode is not established. When the A/L mode is armed, the A/L switchlight comes on and the A/L ARM, LOC ARM, and GS ARM modes are annunciated on the AFCS MODES annunciator indicators.

If an autopilot has been engaged, the second autopilot may be engaged in the CMD configuration in preparation for a dual-autopilot fail-operational performance. The following conditions must be satisfied to engage the second autopilot engage switch (bat handle) on the APFDS ENGAGE panel in the CMD position:

First autopilot engaged in CMD configuration

A/L mode selected

VOR select switch on the NAV MODE select panel in SPLIT position

Roll channel command enable signal valid

Computational monitors valid before A/L track (glideslope track)

Vertical gyro No. 3 (Ref. 34-21-00) or inertial unit No. 3 (Ref. 34-43-00) valid before A/L track

Both VOR receivers (Ref. 34-55-00) valid before A/L track

Both VHF navigation control panels (Ref. 34-55-00) tuned to an ILS frequency

Both ILS receivers (Ref. 34-33-00) valid before A/L track

Both radio altimeter receivers/transmitters (Ref. 34-32-00) valid before A/L track

Both yaw computers valid before A/L track

One auto trim channel (Ref. 22-18-00) valid before A/L track

All conditions to engage the bat handle in the CWS position

Precapture guidance modes which may be used with the A/L mode established are pitch attitude hold, roll attitude/heading hold, heading select, altitude hold, vertical speed, and altitude select.

(a) Roll Axis AUTOLAND

The roll axis A/L mode (Ref. Fig. 5) provides the capability to capture and track the localizer beam consistent with Category II and Category III accuracies and performance requirements. The localizer beam is captured as in the localizer (LOC) mode. The localizer beam guidance is complemented with additional computations resulting in lateral alignment of the aircraft with runway heading and ground rollout.

The roll computers compute roll command signals as a function of localizer deviation signals from the vertical gyros/inertial units, aileron crossfeed signals from the yaw computers, and lateral acceleration signals from the lateral accelerometer unit. The roll command signal is a combination of the localizer deviation signal and the aircraft roll attitude. The localizer deviation signal gain is reduced by the radio altitude signal from the radio altimeter receiver/transmitter to compensate for beam convergence as the aircraft approaches the localizer station. The roll attitude signal is summed with the lateral acceleration signal and processed to eliminate errors due to gyro and accelerometer misalignment. The processed deviation and roll attitude signals are summed to produce a roll command signal.

When performing a forward slip maneuver before touchdown, the roll command signal is modified by the aileron crossfeed signal to reduce errors during the transition from crab angle to roll angle.

The roll command signal is limited to provide a maximum aircraft bank angle of 10 degrees during the A/L mode, 5 degrees during runway alignment, and 0 degree during the go-around mode. The limited signal is dampened by the lateral acceleration and roll attitude signals.

Once the roll maneuver starts, the roll command signal is canceled, and the ailerons are returned to neutral by a roll rate signal. The roll rate signal is the roll attitude signal that has been passed through a high-pass filter.

(b) Pitch Axis AUTOLAND

The pitch axis A/L mode (Ref. Fig. 6) consists of glide path tracking and flare. The glideslope beam is captured as in the approach mode. When the glideslope is captured, the mode annunciation changes from GS ARM to GS on the AFCS MODES indicators.

The aircraft goes into the glideslope track (A/L track) approximately 30 seconds after glideslope capture. At this point, the AFCS MODES indicators display the LOC, GS, FLR ARM, and the ALN ARM (yaw SAS mode) modes. In addition, the AFCS MODES indicator A/L ARM annunciation changes to A/L to indicate that A/L track is achieved. If both autopilots are engaged and the first failure has occurred, the A/L annunciation remains with the AFCS WARNING indicators displaying the NO DUAL warning. In this condition, the APFDS ENGAGE panel bat handle associated with the failed autopilot remains engaged.

The glideslope error signal gain changes as a function of the radio altitude signal from the radio altimeter. The gain is constant until the aircraft reaches the 600-foot level. The pitch computer glideslope multiplier starts to decrease the glideslope error signal gain linearly down to 0 at 50 feet radio altitude. The reduction in the glideslope error signal gain compensates for the increase in signal strength as the glide path transmitter is approached.

At 50 feet radio altitude, the flare mode is engaged. The FLR ARM annunciation of the AFCS MODES indicators is changed to FLARE. The indicators also annunciate A/L, LOC, GS, and ALIGN (yaw SAS mode annunciated at 150 feet radio

altitude). The pitch computer flare multiplier reduces the flare signal gain linearly as a function of the radio altitude in reaching the desired sink rate at the point of touchdown.

(3) Go-Around

The go-around mode is available for autopilot and flight director control. When an approach has failed to meet the landing requirements, the mode selection is made by depressing the takeoff/go-around switch located on the control wheel. The mode provides the capability for an optimum go-around maneuver. The go-around mode results in pitch guidance computation by the speed control system. Pitch command is provided to rapidly arrest the descent rate and provide a programed climbout profile.

R R R Go-around engagement is indicated by the GO ARND (on aircraft without SB34-178) TO/GA (on aircraft with SB34-178) annunciation on the AFCS MODES annunciator indicators. If the go-around is engaged during the dual AUTOLAND mode, the second autopilot is C automatically disengaged. If go-around is engaged during a single autopilot approach or the AUTOLAND mode, the operating autopilot remains engaged. All pitch axis guidance computations are overridden until the go-around mode is disengaged by selecting one of the pitch axis control modes.

Upon go-around engagement, the pitch computer generates a go-around logic signal which is applied to the speed control computer switching circuits. The switching circuits disable the autothrottle computation and activates the go-around computation (Ref. 22-31-00). The go-around computation by the speed control computer results in go-around pitch command signals to both pitch computers. The pitch command signals are compared in the pitch computers to ensure the integrity of the signals. The pitch command signal associated with the engaged autopilot is then rate limited, mixed with attitude rate signals, voted, and processed through the servo amplifiers. The resulting outputs are the pitch command signals applied to the stabilizer autopilot servo. If the autopilot is engaged in the basic (CWS) mode, or if the flight director is engaged for manual control, the pitch command signals are sent to the attitude director indicators (ADI) for steering command displays. The ADI also receives the go-around command signal from the speed control computer for display on the fast-slow indicator to monitor the go-around maneuver.

The go-around mode is disengaged by selecting one of the pitch axis control modes (altitude hold, vertical speed, indicated airspeed hold, and Mach hold. The speed control computer then reverts to the throttle command computations.

In the roll axis, the go-around mode selection initiates a wings-level command. After initial stabilization, either the heading select or localizer mode is selected for lateral guidance.

(4) Takeoff

The takeoff mode is a flight director mode only. The mode is initiated by depressing the takeoff/go-around switch on the control wheel. With the aircraft on the ground and the takeoff mode initiated, the takeoff mode automatically engages as a function of the main landing gear strut switch, throttle lever position, flight director engagement, and other interlocks.

On aircraft without SB34-178,
the takeoff mode is indicated by the TAKEOFF annunciation on the AFCS MODES annunciator indicators. The takeoff mode results in pitch guidance computation performed by the speed control computer and wings-level command computation in the roll computers.

The takeoff mode computations performed in the speed control computer are the same as for the go-around mode. The computed takeoff pitch command signals are processed through the pitch computers whose outputs are applied to the attitude director indicators (ADI) for steering command displays. The ADI command bar slowly moves up as the aircraft acceleration increases on the runway with control wheel steering used to follow the command bar. The computation minimizes pitch overshoots and limits the takeoff angle to a maximum of 15.2 degrees.

The takeoff mode is disengaged by selecting one of the pitch axis control modes (altitude hold, vertical speed, indicated airspeed hold, and Mach hold). The speed control computer then reverts to the throttle command computations. The takeoff mode can also be disengaged by turning off the flight director.

(5) Turbulence

The turbulence mode is selectable for the autopilot function only to minimize the effects of turbulence. The mode is engaged by depressing the TURB switchlight

on the APFDS ENGAGE panel. Upon mode engagement, the TURB switchlight comes on, and the AFCS MODES indicators annunciate the TURB mode. Engagement of the mode results in disengagement of all existing autopilot modes except the AUTOLAND and go-around modes. The turbulence mode places the autopilot in the basic configuration, with attitude gain lowered by half and control wheel steering available. The automatic trim function is also disabled during turbulence control. The turbulence mode cannot be superseded by any other mode until disengaged by a second actuation of the TURB switchlight or by disengaging the autopilot.

I. Autopilot Disengage Status

The autopilot is manually disengaged by depressing the autopilot disengage switch on either the Captains or First Officers control wheel. The autopilot can also be disengaged by manually placing the autopilot engage switch (bat handle) on the APFDS ENGAGE panel to the OFF position.

Automatic disengagement due to detected failure(s) is controlled by the pitch computers. The pitch computer provides the CMD or CWS engage enable signal (ground) to energize the associated solenoid to hold the bat handle in the engaged position. The pitch computer evaluates the type of failure and removes the applicable enable signal, which releases the bat handle. The bat handle is released from the CMD to the CWS position, from the CMD to the OFF position, or from the CWS to the OFF position, depending upon which mode is engaged and the type of failure.

Autopilot disengagement is annunciated on the AFCS WARNING indicators. The indicators include the AP DISC, NO DUAL, and CMD DISC warnings, which are activated by logic signals (ground) from the roll computers. The warning annunciations are accompanied by a flashing ALERT switchlight on the indicators.

(1) Basic Configuration

In the basic autopilot configuration, the APFDS ENGAGE panel bat handle is automatically released from the CWS to the OFF position, which causes AP DISC warning annunciation, when any of the following conditions occurs:

Autopilot disengage switch depressed

Servo monitors not valid

Associated pitch or roll computer power supply not valid

Associated pitch or roll computer not valid

Associated vertical gyro or inertial unit not valid

Associated compass system not valid

Both yaw system channels not valid

Both auto trim channels not valid

(2) Command Cruise Configuration

A mode release logic signal in the associated pitch computer releases the APFDS ENGAGE panel bat handle from the CMD position into the CWS position, when the turbulence mode is selected or if a sensor signal used in a flight mode becomes invalid. This condition results in annunciation of the CMD DISC warning.

The bat handle is automatically released from the CMD position to the OFF position, which causes AP DISC warning annunciation, when any of the following conditions occur:

Autopilot disengage switch depressed

Associated pitch or roll computer power supply validity loss

Servo monitor validity loss

Computation validity loss

Associated vertical gyro or inertial unit validity loss

Associated compass system validity loss

Validity loss in both yaw SAS channels

Validity loss in both auto trim channels

(3) Single Autopilot AUTOLAND Mode

In the single autopilot A/L mode, before the A/L track mode is engaged, any of the following conditions will release the APFDS ENGAGE panel bat handle from the CMD

position to the CWS postion, which causes CMD DISC warning annunciation:

Associated radio altimeter not valid

Associated ILS receiver not valid

Associated ILS receiver frequency incorrectly set (VHF NAV control panel set to a VOR, rather than an ILS frequency)

Barometric altitude (from CADC) not valid

After A/L track mode engagement, any of the following conditions will release the bat handle from the CMD position to the OFF position, which causes AP DISC warning annunciation:

Associated pitch or roll computer power supply validity lost

Servo validity lost

Combination of failures invalidating two or more of the A/L computations

(4) Dual Autopilot AUTOLAND Mode

Before selecting the A/L mode of operation, the roll computer dual-operation-not-available logic circuit assesses the fail-operational status of the roll computer, the yaw SAS, the pitch computer, and the trim augmentation computer. The roll computer combines and assesses all the failure information and turns on the DUAL A/L NOT AVAIL master caution indicator, if required.

When the A/L mode is selected, the roll computer first-failure logic circuit assesses the condition of the above-mentioned components to determine their fail-operational status. If there has been a detected failure, any attempt to engage the second autopilot engage switch (bat handle) on the APFDS ENGAGE panel will not be possible. The A/L mode then will be a single autopilot operation. If there has been no detected failure, the second bat handle engages for a dual-autopilot operation.

In the dual A/L mode, after A/L track is achieved, any of the following conditions will not disengage the autopilots (APFDS ENGAGE panel bat handles remain engaged in the CMD position):

Validity loss of one vertical gyro or inertial unit

Validity loss of one ILS receiver, or one radio altimeter

Validity loss of one yaw SAS channel

Validity loss of both auto trim channels

One autopilot disengages, which causes NO DUAL annunciation, when the associated bat handle is manually released from the CMD to the OFF position, or when the validity of the associated pitch or roll computer is lost (first failure).

Any of the following failures (second autopilot failure) disengages both autopilots, which results in the release of both APFDS ENGAGE panel bat handles to the OFF position and an AP DISC warning annunciation:

Loss of all pitch or roll computation validity

Loss of both yaw SAS channels

Loss of any two vertical gyros or inertial units

Loss of any two accelerometers in the normal or lateral accelerometer unit

Loss of both ILS receivers

Loss of both radio altimeters

(5) Autopilot Aileron Authority Limit

The autopilot aileron authority, normally controlled by an electronic limiting, is further limited to prevent aileron control hardovers during all but control wheel steering influenced mode and AUTOLAND track mode of autopilot operation. An aileron autopilot limiter switch mechanism in the aileron control system (Ref. 27-11-00) measures the autopilot commanded aileron angle relative to a mechanical trim. If the aileron angle exceeds ±13-degree authority limit, the switch mechanism provides discrete signals to the autopilot to cause an automatic disengagement. The disengagement is indicated by the AP DISC warning and the 2-second aural warning.

J. Flight Director Failure Status

During flight director (FD) operation, the roll computer provides a flight director valid signal to keep the FD flag on the associated attitude director indicator (ADI) out of view. The signal becomes invalid and the FD flag is driven into view, and the steering bars are automatically biased out of view if the associated flight director detects any of the following conditions:

Pitch or roll computer power supply validity loss

Validity loss of cruise mode sensor in use

Vertical gyro or inertial unit validity loss

Compass system validity loss before A/L track

Speed command validity loss or takeoff/go-around comparator validity loss after takeoff or go-around engagement

Validity loss in VOR receiver, ILS receiver, or radio altimeter after A/L track engagement

Computational validity loss during A/L track operation

K. Go-around Failure

A go-around failure signal is provided by the speed control computer to the pitch computer when discrepancies are sensed during the go-around mode. The NO GA warning is annunciated along with a flashing ALERT switchlight on the AFCS WARNING indicators during GS track and not in GA mode and ATS not disconnected. The warning is cancelled by two successive pushes of the ALERT switchlight or by selecting another pitch axis mode.

L. Fault Isolation Monitoring

See 22-09-00 for fault isolation monitor (FIM) description and operation.

R

AFCS MODES OF OPERATION - FAULT ISOLATION

R 1. General

R System fault isolation is broken down into operational mode
R problems encountered during normal flight operation and testing.
R The following sections provide detailed testing and fault
R isolation procedures:

R	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	FD Basic Mode - Fault Isolation
R	22-10-33	Autopilot A CWS/CMD Mode - Fault Isolation
R	22-10-35	Autopilot B CWS/CMD Mode - Fault Isolation
R	22-11-31	FD Vertical Speed Mode - Fault Isolation
R	22-11-33	FD Altitude Hold Mode - Fault Isolation
R	22-11-35	FD Altitude Select Mode - Fault Isolation
R	22-11-37	FD IAS Hold Mode - Fault Isolation
R	22-11-39	FD MACH Hold Mode - Fault Isolation
R	22-11-43	Turbulence Mode - Fault Isolation
R	22-12-19	FD Localizer Mode - Fault Isolation
R	22-12-21	FD Approach Mode - Fault Isolation
R	22-12-29	Takeoff Mode - Fault Isolation
R	22-12-37	DUAL A/L NOT AVAIL (DANA) - Fault Isolation
R	22-12-39	Go Around Mode - Fault Isolation
R	22-13-31	FD Heading Select Mode - Fault Isolation
R	22-13-35	FD NAV (VOR) Mode - Fault Isolation
R	22-14-31	AUTOLAND Mode (Total Sequence) - Fault Isolation
R R	22-14-33	AUTOLAND Mode (Pre-Track and Track) - Fault Isolation
R R	22-14-35	AUTOLAND Track Mode (Align, Flare and Rollout) - Fault Isolation

R The preliminary procedures for the above fault isolation procedures are located in 22-12-00 maintenance practices. speed computer functions, pitch basic, pitch AUTOLAND, trim, DLC/AGSB, PFCS and PFCS misc.

APFDS MODES OF OPERATION - MAINTENANCE PRACTICES

1. General

The APFDS modes of operation maintenance practices provide the preliminary procedures required when performing fault isolation in the following Sections:

SECTIONS
22-10-31
22-10-33
22-10-35, 501
22-11-31
22-11-33
22-11-35
22-11-37
22-11-39
22-11-43
22-12-19
22-12-21
22-12-29
22-12-37
22-12-39
22-13-31
22-13-33
22-13-35
22-14-31
22-14-33
22-14-35

2. Equipment and Materials

A. Test equipment required for 22-11-37, 22-11-39, 22-11-37, 22-11-31, 22-11-35 and 22-13-31:

Air Data Tester, Milhard Engineering Co., Part No. 127, or equivalent (2 required)

Pitot-Static Adapter Kit, Milhard Engineering Co., Part No. 127-1011, or equivalent

B. Test equipment required for 22-13-35, 22-12-19, 22-12-21, 22-14-31, 22-14-33, 22-14-35, and 22-12-37:

VOR/ILS Ramp Test Set T-30, or equivalent

C. Test equipment required for 22-12-21, 22-10-33, 22-10-35, 501, and 22-12-37:

Radio Altimeter Test Set, Collins 980N-1, with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable Assembly

R NOTE: To preclude possible radio altimeter mutual
R interference problems, use of the 980N-1 Dual Adapter
R (active) cable, with the radio altimeter test set is
R recommended.

R If the 980N-1 (passive) Adapter Cable is used for
R autoland testing, temporary shielding of the radio
R altimeter antennas may be required for successful
R completion of test.

R CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED
R FOR SHIELDING MUST BE SUCH THAT REMOVAL BEFORE
R FLIGHT IS GUARANTEED.

D. Test equipment required for 22-12-37:

AC/DC Voltmeter - Range 0.01 - 100 volts.

Breakout Cable Assembly for Yaw Computer, G/ITEL No. 22-00-19 (See 22-12-37, Fig. 108).

Breakout Cable Assembly for Pitch and Roll Computers, G/ITEL No. 22-00-20 (See 22-12-37, Fig. 109).

3. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
32-63-00	Air/Ground Sensing System - Maintenance Practices
34-14-00	Central Air Data Computer System - Maintenance Practices
34-21-00	Attitude Reference System - Maintenance Practices
34-22-00	Magnetic Heading Reference System - Maintenance Practices
34-32-00	Radio Altimeter System - Maintenance Practices

34-33-00 Instrument Landing System - Maintenance Practices

34-55-00 VOR System - Maintenance Practices

4. Preliminary Procedures

The preliminary procedures consists of flight director setup, autopilot setup, and AUTOLAND setup. The preliminary procedures are performed "in-part or in-total" on an as required basis.

A. Flight Director Setup

(1) On APFDS ENGAGE panel, ensure that AP A and B switches and FD A and B switches are set to OFF.

(2) Turn on electrical power (Ref. 24-00-00).

(3) Verfy that avionics cooling is on (Ref. 21-00-00).

(4) On pilots overhead circuit breaker panel CB1 (called CB1 in rest of procedure), ensure that the following circuit breakers are closed:

AUTO THROT SERVO (A1)

CAPT & F/O SPEED CONT (A2, A20)

CAPT & F/O YAW SAS (A5, A23)

CAPT & F/O PITCH & ROLL (A6, A24)

CAPT & F/O AFCS MODE IND (B1, B19)

FCES COMPUTERS DC & AC & LEFT AOA (B4, B5)

FCES STICK SHAKE (B6)

SPOILER DWELL DC & AC (B7), (B8)

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

CAPT & F/O RADIO ALTM (D4, D22)

CAPT & F/O INSTR CMPRN MON (D8, D26)

ALT SOURCE SEL-CAPTS INSTR (E1)

ALT SOURCE SEL-F/O INSTR (E2)

CAPT & F/O VERT SP IND (E4, E21)

INS PWR (E6)

INS HTR (E7)

R ALTERNATE ADI (E19)

INS-3/GYRO-3 (E24)

CAPT & F/O IAS/MACH (F1, F19)

CAPT & F/O ADI (F2, F20)

CAPT & F/O HSI (F3, F21)

CAPT & F/O ALTM (F4, F22)

INST XFMR 1, 2 & 3 (F5, D9, D27)

CAPT & F/O DIR GYRO (G5, G23)

ILS (G4, G22)

VG/INS 1 (G-6)

CAPT & F/O CMPS CPLR (G7, G26)

CAPT & F/O AIR DATA CMPTR (G8, G27)

INS/VERT GYRO (G24)

INS HTR (G25)

CMPS CPLR 1 STANDBY (K19)

CMPS CPLR 1 & 2 (K24, J19)

ALT ALERT 1 & 2 (K27, J21)

AURAL WARN-MULT SND (L8)

ANN RESET (L9)

On the FE/SO overhead circuit breaker panel CB2 (called CB2 in rest of procedure), ensure that the following circuit breakers are closed:

RIGHT AOA (F1)

F/E IND LT TEST - 1, 2, 3, 4 and 5 (H1, H2, H3, H4, H5)

PILOTS IND LT TEST - 1, 2 and 3 (H8, H9, H10)

DLC SERVO A (H14)

DLC SERVO B (H15)

AFCS WARNING CAPT (K18)

AFCS WARNING F/O (K19)

R (5) Verify that the following systems are on:

R Air Data Computer System (Ref. 34-14-00)

R Attitude Reference System (Ref. 34-21-00)

R Magnetic Heading Reference system (Ref. 34-22-00)

R Radio Altimeter System (Ref. 34-32-00)

R Instrument Landing System (Ref. 34-33-00)

R VOR System (Ref. 34-55-00)

(6) On Captains (Capt) and First Officers (F/O) overhead COMPASS panels, verify that MAG/DG switchlights are set to MAG.

NOTE: The local magnetic environment may cause disagreement between the HSI indications. In this event, both compass systems must be switched to the DG mode. Under these conditions, the alignment between the compass systems must be checked prior to performing any test which requires engagement of the AUTOLAND mode. A difference between systems of more than 6 degrees will cause display of the NO ALIGN message on the AFCS WARNING indicators during AUTOLAND.

(7) On Capt and F/O horizontal situation indicators (HSI), verify that indicated magnetic headings are approximately the same. This existing magnetic heading is hereafter referred to as "aircraft heading".

(8) On HEADING/PITCH MODE panel, set HEADING knob to aircraft heading. Verify that heading bug on each HSI indicates aircraft heading.

(9) On NAV MODE panel, set both COURSE knobs to aircraft heading.

R (10) When performing FD tests described in 22-12-19 through
R 22-12-37, remove AFCS/MLG accessory unit from center
R rack in FESC (as required for each test procedure).
(This simulates aircraft in-air condition.)

B. Autopilot Setup

WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Perform Flight Director Setup described in Paragraph 4A.

(2) Install AFCS/MLG accessory unit in center rack of FESC, if removed.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

THE HORIZONTAL STABILIZER WILL ALWAYS RETURN TO THE +1 DEGREE POSITION (AGAINST ACTUATOR STOPS) INDEPENDENT OF THE POSITION OF THE COLUMNS WHENEVER ALL HYDRAULIC SYSTEMS ARE OFF. THEREFORE, AFTER ALL TESTS, THE CONTROL COLUMNS SHALL BE POSITIONED TO OBTAIN A +1 DEGREE READING ON THE SURFACE POSITION INDICATOR (SPI) BEFORE SHUTTING DOWN THE HYDRAULIC SYSTEMS.

DURING PERFORMANCE OF FOLLOWING TESTS, THE PILOTS CONTROL COLUMN AND WHEELS WILL MOVE. STAY CLEAR OF THESE CONTROLS AT ALL TIMES.

(3) Turn on hydraulic systems A and B (Ref. 29-11-00). If hydraulic power is turned off during this test, depress the FCES panel YAW SAS 1 and 2 switchlights to OFF, and then to on (dark) when hydraulic power is restored. This is to prevent the display of DUAL A/L NOT AVAIL message on caution and warning panel, and of NO DUAL messages on AFCS WARNING indicator.

NOTE: Avoid the use of aircraft electrical hydraulic pumps for this check. If pumps must be used,

limit use time to 20 minutes to prevent overheating.

C. AUTOLAND Setup

(1) Perform Flight Director Setup described in Paragraph 4A.

(2) Perform Autopilot Setup described in Paragraph 4B.

(3) When removed, install AFCS/MLG accessory unit.

(4) On CB1, open and tag MISC-RAT AUTO DEPLOY (L3) circuit breaker. On CB2, open and tag NOSE STEERING (F19) circuit breaker.

(5) On Capt and F/O INSTRUMENT SOURCE SELECT PANELS, all switchlights shall be off (dark) for entire AUTOLAND test.

(6) Set both VHF NAV panel frequency selectors to 108.1 MHz.

(7) Position ILS test set T-30 in cockpit. Set LOC and GS selectors to VARIABLE and establish zero LOC and GS beam deviation indications on HSI. Turn on localizer and glideslope POWER switches only as required during tests, to preserve batteries.

(8) Verify that RAT ground safety lock is installed.

(9) On FCES panel, depress following switchlights to OFF.

YAW SAS 1 and 2

STALL WARN 1 and 2

PITCH TRIM 1 and 2

DLC/AUTO SPLR 1 and 2

ATS 1 and 2

MACH TRIM 1 and 2

R (10) On flight control panel, depress MACH FEEL 1 and 2 switchlights to OFF.

R (11) On center console, set manual PITCH TRIM WHEEL to an index of approximately 5.5. (This position and the corresponding control column position will be called neutral position for this test).

R (12) On center console, set manual ROLL trim wheel to an index of zero.

R (13) On FCES panel, depress following switchlights to on (dark):

YAW SAS 1 and 2

PITCH TRIM 1 and 2

R (14) On PFCS MONITOR panel, ensure that RUDDER switch and L INBD AILERON switches are set to on, and that all STABILIZER switches are on.

R (15) Set all throttle levers to idle.

R (16) Set flaps to 33 degrees.

NOTE: CONTROL COLUMN MOTION AND AP LIMIT. During tests with the approach or AUTOLAND mode engaged, the control columns will move and the pitch trim wheels on the center console will rotate at various times during the glideslope capture and track sequence. Column and trim wheel motion can be temporarily stopped, or reversed, by carefully adjusting the glideslope beam error signal output from the test set. If the columns reach their limit of travel in the fore or aft direction under these conditions and the beam error signal is not changed, an AP LIMIT message may be displayed on both AFCS WARNING indicators at some time thereafter.

These actions and the warning messages may be ignored during performance of the various tests, except as specifically noted herein. Column motion will also result when the normal accelerometers are exercised. When the autopilot is disengaged, AP LIMIT messages will be removed from view.

NOTE: CONTROL WHEEL MOTION. During tests with the AUTOLAND mode engaged, the pilots control wheels will move in response to localizer beam error signal inputs and tilting the lateral accelerometers.

NOTE: AIRCRAFT OSCILLATION. During tests with the AUTOLAND mode engaged, the aircraft may oscillate at a low frequency due to stabilizer motion/normal accelerometer interaction. This oscillation is a normal aircraft/AFCS ground

testing characteristic and may be ignored during performance of the various tests. Oscillation amplitude is decreased when AP LIMIT warning messages are displayed, or if the glideslope beam error is adjusted to minimize motion of the stabilizer when AP LIMIT messages are not displayed. (To reduce stabilizer motion, a glideslope beam error signal greater than zero volts may be required).

AUTOLAND tests require that all other auto flight system components and associated equipment are installed and operational. Also, the performance of concurrent tests on other systems is to be avoided, in that they may interfere with the performance of this test. Warning annunciations and/or fail lights that appear, in addition to those specifically called out in these procedures, do not necessarily invalidate this inspection and test procedure. They merely indicate that a procedural fault or a unit failure has occurred and can be corrected separately from these procedures.

R (17) On FCES panel, depress STALL WARN 1 switchlight. If the FAIL legend is illuminated, discontinue testing until the fault has been isolated and corrected.

R (18) Depress STALL WARN 1 to off (dark).

R (19) On CB1, open and then close PITCH & ROLL (A6) and (A24) circuit breakers.

R (20) For fault isolation procedures 22-14-33, 22-14-35 and 22-12-37: connect radio altimeter test set (for DANA fault isolation, Ref. 22-12-33) as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) On test set, set TEST SELECT switch to OFF.

(c) In mid-electrical service center, connect test set plug P1 to TEST connector on radio altimeter RT No. 1. Connect test set plug P2 to TEST connector on radio altimeter RT No. 2.

(d) Close D4 and D22 circuit breakers.

(e) Using test set, establish an altitude of 480 feet as indicated on instrument panel radio altitude indicators.

R # FD LOCALIZER MODE - FAULT ISOLATION

R 1. General

R The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for appropriate fault isolation. Figure 101 and 102 provide component location for FD Localizer Mode troubleshooting.

R 2. Equipment and Materials

R VOR/ILS Ramp Test Set T-30, or equivalent

R 3. Referenced Procedures

R	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-02-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-10-31	Flight Director Basic Mode - Fault Isolation
R	22-13-31	Flight Director Heading Select Mode - Fault Isolation

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – RGLL	2	FESC, CTR RACK/112AB	22-13-01
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT & F/O INSTR PNL	22-10-05
INDICATOR – ATTITUDE DIRECTOR	2	FLT STA, CAPT & F/O INSTR PNL	34-21-07
PANEL – NAVIGATION MODE SELECT	1	FLT STA, GLARSHLD PNL	22-10-02
UNIT – VHF NAVIGATION ACCESSORY	1	FESC, REAR RACK/112AB	34-55-06

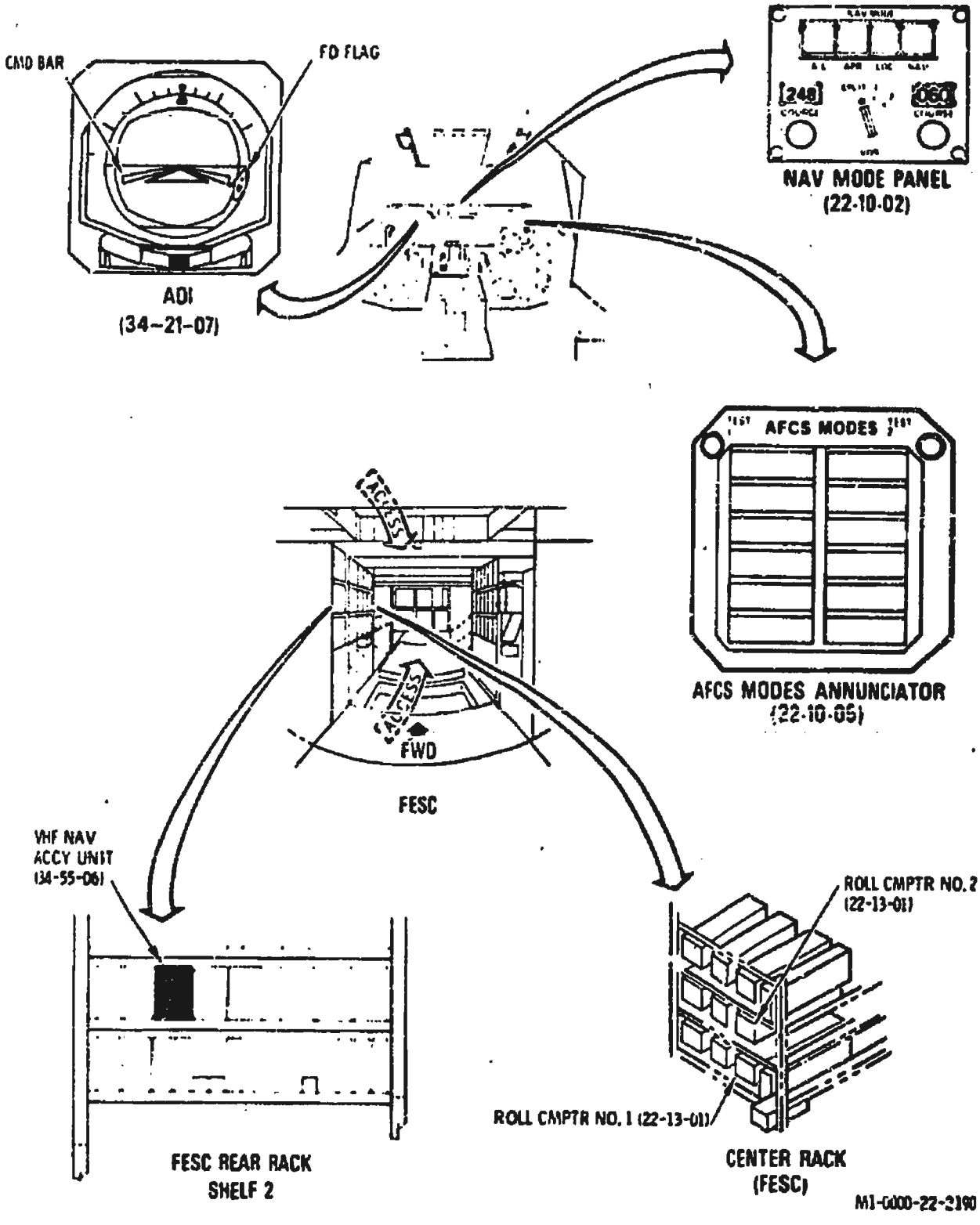
M1-0000-22-2188

R
R

Component Location Index
Figure 101

EFFECTIVITY: ALL

001B



R FD Localizer Mode Component Locator Diagram
R Figure 102

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00, maintenance
R practices.

R B. FD Localizer Mode Test

R (1) On APFDS ENGAGE panel, set both FD switches to ON.

R RESULT:

R Both ADI command bars come into view and are
R level.

R Both ADI FD flags are out of view.

R (2) On glareshield, set both VHF NAV frequency selectors to
R 108.1 MHz.

R (3) On VOR/ILS ramp test set, turn on LOC POWER switch
R (Ref. 34-33-00).

R (4) On ILS test set, adjust LOC for a 2 dot steer-right
R indication on both HSIs.

R (5) On NAV MODE panel, depress LOC switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, LOC ARM messages
R are displayed.

R (6) On ILS test set, adjust LOC for a zero deviation
R indication on both HSIs.

R RESULT:

R On both AFCS MODES annunciators, LOC messages are
R displayed within 15 seconds.

R On both ADIs, FD flags are out of view, and
R command bars are centered and level.

R On AFCS WARNING panels, NO ALIGN message comes on,
R and ALERT light flashes within one minute.

R (7) On NAV MODE panel, rapidly rotate left COURSE knob
R clockwise 40 degrees from aircraft heading.

R RESULT:

R On Capt ADI, command bar commands right roll and
R starts to return to level within 15 seconds.

R (8) On NAV MODE panel, rapidly rotate right COURSE knob
R clockwise 40 degrees from aircraft heading.

R RESULT:

R On F/O ADI, command bar commands right roll and
R starts to return to level within 15 seconds.

R (9) Depress LOC switchlight to off.

R (10) Set both COURSE readouts to aircraft heading, and
R depress LOC switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, LOC messages are
R displayed.

R (11) On CB1, open ILS (G4) and (G22) circuit breakers.

R RESULT:

R On both ADIs, FD flags are in view and command
R bars are biased out of view.

R (12) Close G4 and G22 circuit breakers, and wait 30 seconds
R before performing next step.

R (13) On ILS test set, adjust LOC for a 1-dot steer-right
R indication on both HSIs.

R RESULT:

R On both ADIs, command bar commands right roll
R within 15 seconds.

R (14) Set both FD switches to OFF.

R 5. Fault Isolation Identification

R A. General

R Table 101 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 102. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R FD Localizer Mode Fault Isolation Summary
Table 101

TEST REF.	FAULT	FAULT NO.
4B(1)	ADU fault indication	(1)
4B(5)-1	LOC switchlight not illuminated	(2)
4B(5)-2	LOC ARM message not displayed on Capt AFCS MODES annunciator	(3)
4B(5)-3	LOC ARM message not displayed on F/O AFCS MODES annunciator	(4)
4B(6)-1	LOC message not displayed on Capt AFCS MODES annunciator	(5)
4B(6)-2	LOC message not displayed on F/O AFCS MODES annunciator	(6)
4B(6)-3	FD flag displayed on Capt ADI	(7)
4B(6)-4	Command bar not level on Capt ADI	(8)
4B(6)-5	FD flag displayed on F/O ADI	(9)
4B(6)-6	Command bar not level on F/O ADI	(10)
4B(7)-1	Command bar does not move on Capt ADI	(11)
4B(7)-2	Command bar does not level on Capt ADI	(12)
4B(8)-1	Command bar does not move on F/O ADI	(13)

FD Localizer Mode Fault Isolation Summary (Cont)
Table 101

TEST REF.	FAULT	FAULT NO.
4B(8)-2	Command bar does not level on F/O ADI	(14)
4B(9)	LOC switchlight remains illuminated	(15)
4B(11)-1	FD flag not displayed on Capt ADI	(16)
4B(11)-2	FD flag not displayed on F/O ADI	(17)
4B(13)-1	Command bar does not move on Capt ADI	(18)
4B(13)-2	command bar does not move on F/O ADI	(19)

Schematics for Fault Isolation of FD Localizer Mode Problem
Table 102

TITLE	LOCATION
Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic	22-13-00, Schem 5
A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7

R B. FD Localizer Mode

R (1) Fault: ADI fault indication

R (a) Perform Steps (1) and (2) of FD basic mode test
R procedure (Ref. 22-10-31).

R ---

R (2) Fault: On NAV MODE panel, LOC switchlight not
R illuminated

R (a) Can lamp test procedure (Ref. 22-02-01) be
R performed with no indicated LOC switchlight fault?

R Yes: Replace NAV MODE panel (Ref. 22-10-02).

R No: Perform lamp fault isolation procedure (Ref.
R 22-02-01).

R ---

R (3) Fault: On Capt AFCS MODES annunciator, LOC ARM message
R not displayed

R (a) On Capt AFCS MODES annunciator, is LOC message
R displayed?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).
R If problem persists, replace roll computer No. 2.

R No: Go to Step (b).

R (b) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated LOC
R ARM message fault?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).
R If problem persists, replace NAV MODE panel (Ref.
R 22-10-02). If problem persists, replace Capt AFCS
R MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R ---

R (4) Fault: On F/O AFCS MODES annunciator, LOC ARM message
R not displayed

R (a) On F/O AFCS MODES annunciator, is LOC message
R displayed?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, replace roll computer No. 1.

R No: Go to Step (b).

R (b) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated LOC
R ARM message fault?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, replace NAV MODE panel (Ref.
R 22-10-02). If probelm persists, replace F/O AFCS
R MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R ---

R (5) Fault: On Capt AFCS MODES annunciator, LOC message not
R displayed

R (a) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated LOC
R message fault?

R Yes: Replace roll computer No. 1 (Ref. 22-13-00).
R If problem persists, replace Capt AFCS MODES
R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R ---

R (6) Fault: On F/O AFCS MODES annunciator, LOC message not
R displayed

R (a) Can mode annunciator press-to-test procedure (Ref.
R 22-02-01) be performed with no indicated LOC
R message fault?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, replace F/O AFCS MODES
R annunciator (Ref. 22-10-05).

R No: Perform mode annunciator fault isolation
R procedure (Ref. 22-02-01).

R ---

R (7) Fault: On Capt ADI, FD flag displayed

R (a) On Capt HSI, is NAV flag displayed?

R Yes: Check ILS navigation system for fault (Ref. R 34-33-00).

R No: Replace roll computer No. 1 (Ref. 22-13-01). R If problem persists, check ILS navigation system R for fault (Ref. 34-33-00).

R ---

R (8) Fault: On Capt ADI, command bar not level

R (a) Replace roll computer No. 1 (Ref. 22-13-01). If R problem persists, replace NAV MODE panel (Ref. R 22-10-02). If problem persists, check ILS R navigation system for fault (Ref. 34-33-00).

R ---

R (9) Fault: On F/O ADI, FD flag displayed

R (a) On F/O HSI, is NAV flag displayed?

R Yes: Check ILS navigation system for fault (Ref. R 34-33-00).

R No: Replace roll computer No. 2 (Ref. 22-13-01). R If problem persists, check ILS navigation system R for fault (Ref. 34-33-00).

R ---

R (10) Fault: On F/O ADI, command bar not level

R (a) Replace roll computer No. 2 (Ref. 22-13-01). If R problem persists, replace NAV MODE panel (Ref. R 22-10-02). If problem persists, check ILS R navigation system for fault (Ref. 34-33-00).

R ---

R (11) Fault: On Capt ADI, command bar does not move

R (a) Can FD heading select mode test procedure (Ref. R 22-13-31) be performed with no indicated fault?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01). R If problem persists, replace VHF NAV accessory R unit (Ref. 34-55-06). If problem persists, R replace NAV MODE panel (Ref. 22-10-02).

R No: Perform FD heading select mode fault
R isolation procedure (Ref. 22-13-31).

R ---

R (12) Fault: On Capt ADI, command bar does not level

R (a) Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (13) Fault: On F/O ADI, command bar does not move

R (a) Can FD heading select mode test procedure (Ref.
R 22-13-31) be performed with no indicated fault?

R Yes: Replace roll computer No. 2 (22-13-01). If
R problem persists, replace VHF NAV accessory unit
R (Ref. 34-55-06). If problem persists, replace NAV
R MODE panel (Ref. 22-10-02).

R No: Perform FD heading select mode fault
R isolation procedures (Ref. 22-13-31).

R ---

R (14) Fault: On F/O ADI, command bar does not level

R (a) Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (15) Fault: On NAV MODE panel, LOC switchlight remains
R illuminated

R (a) On Capt AFCS MODES annunciator, is LOC message
R displayed?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).
R If problem persists, replace NAV MODE panel (Ref.
R 22-10-02).

R No: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, replace NAV MODE panel (Ref.
R 22-10-02).

R ---

R (16) Fault: On Capt ADI, FD flag not displayed

R (a) On CB1, open NO. 1 SYSTEMS/PITCH & ROLL (A6) circuit breaker. On Capt ADI, is FD flag displayed?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).

R No: Replace Capt ADI (Ref. 34-21-07).

R ---

R (17) Fault: On F/O ADI, FD flag not displayed

R (a) On CB1, open NO. 2 SYSTEMS/PITCH & ROLL (A24) circuit breaker. On F/O ADI, is FD flag displayed?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).

R No: Replace F/O ADI (Ref. 34-21-07).

R ---

R (18) Fault: On Capt ADI, command bar does not move

R (a) Can FD heading select mode test procedure (Ref. 22-13-31) be performed with no indicated fault?

R Yes: Replace roll computer No. 1(Ref. 22-13-01).

R No: Perform FD heading select mode fault isolation procedures (Ref. 22-13-31).

R ---

R (19) Fault: On F/O ADI, command bar does not move

R (a) Can FD heading select mode test procedure (Ref. 22-13-31) be performed with no indicated fault?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).

R No: Perform FD heading select mode fault isolation procedures (Ref. 22-13-31).

R ---

FD APPROACH MODE - FAULT ISOLATION

1. General

The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 5 for appropriate fault isolation. Figure
R 101 and 102 provide component location for FD Approach Mode troubleshooting.

2. Equipment and Materials

Radio Altimeter Test Set, Collins Radio 980N-1 with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable Assembly

NOTE: To preclude possible radio altimeter mutual interference problems, use of the 980N-1 Dual Adapter (active) cable, with the radio altimeter test set is recommended.

If the 980N-1 (passive) Adapter Cable is used for autoland testing, temporary shielding of the radio altimeter antennas may be required for successful completion of the test.

CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED FOR SHIELDING MUST BE SUCH THAT REMOVAL BEFORE FLIGHT IS GUARANTEED.

VOR/ILS Ramp Test Set T-30, or equivalent

Type MB-1 Pitot/Static Field Tester; Burton 2024B Pitot/Static Tester; or equivalent (2 req).

3. Referenced Procedures

22-12-00	APFDS Modes of Operation - Maintenance Practices
22-02-01	AFCS Lamps and Annunciators - Fault Isolation
22-10-31	Flight Director Basic Mode - Fault Isolation

	22-11-31	Flight Director Vertical Speed Mode - Fault Isolation
	22-13-31	Flight Director Heading Select Mode - Fault Isolation
R	34-21-00	Attitude Reference System - Maintenance Practices

4. Fault Detection Test

A. Preliminary Procedures

(1) Turn on APFDS as described in 22-12-00, maintenance practices.

B. FD Approach Mode Test

(1) On APFDS ENGAGE panel, set both FD switches to ON.

RESULT:

Both ADI command bars come into view and are level.

Both ADI FD flags are out of view.

(2) On glareshield, set both VHF NAV frequency selectors to 108.1 MHz.

(3) On VOR/ILS ramp test set T-30, turn on localizer and glideslope POWER switches.

(4) Using ILS test set, establish 2-dot LOC deviation and 2-dot GS deviation indications on HSI.

(5) Connect radio altimeter test set 980N-1 as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) On radio altimeter test set, set TEST SELECT switch to OFF.

(c) In mid-electrical service center, connect dual radio cable assembly to TEST connectors on front of both radio altimeter RT units.

(d) Close circuit breakers D4 and D22.

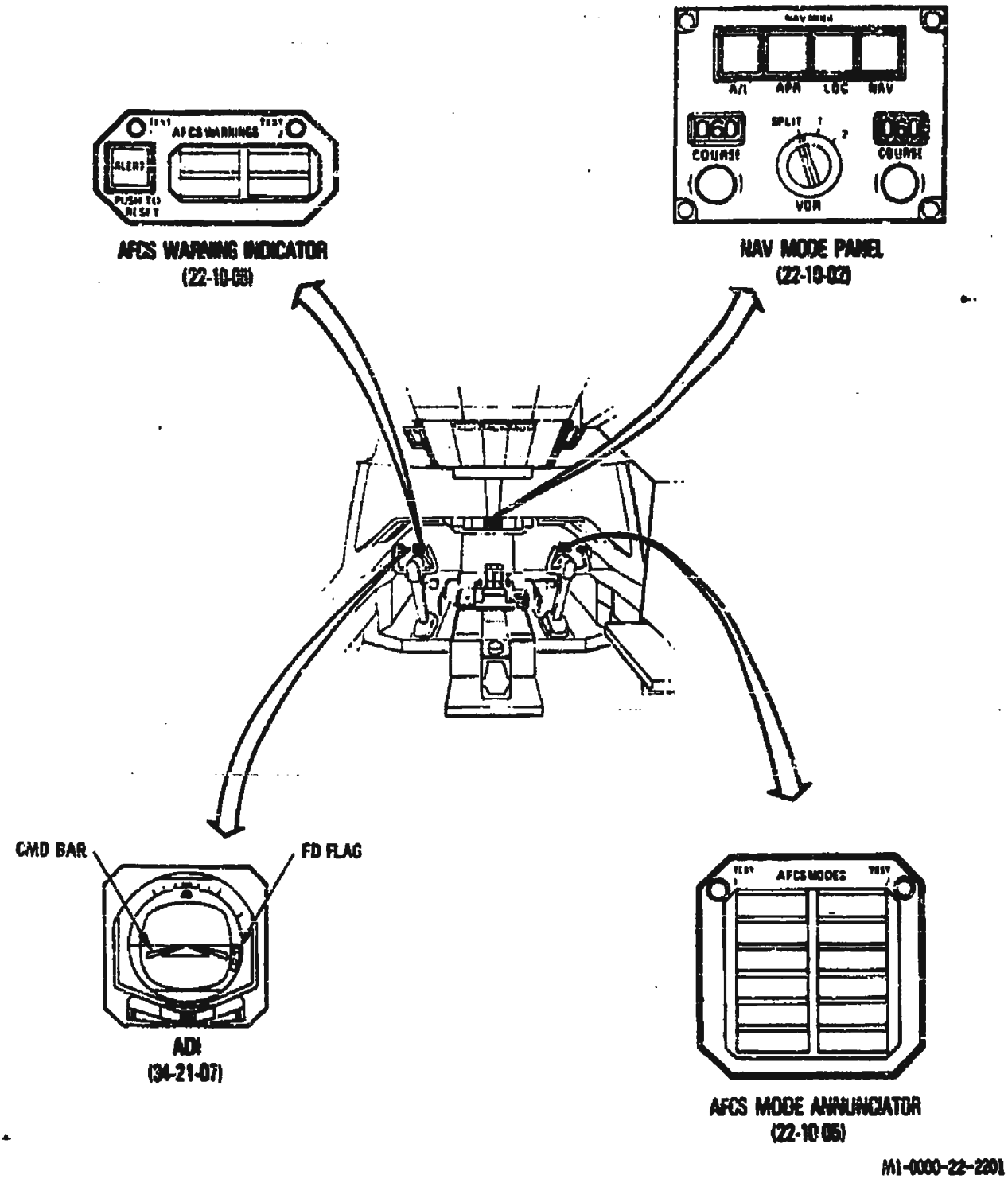
(e) On test set, establish an altitude of 500 feet.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCELEROMETER – NORMAL	1	GALY CLG/135DB	22-11-82
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-81
COMPUTER – TRIM AUGMENTATION	1	FESC, CTR RACK/112AB	22-18-01
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05
INDICATOR – AFCS WARNING	2	FLT STA, CAPT AND F/O INSTR PNL	34-21-07
PANEL – NAVIGATION MODE SELECT	1	FLT STA, GLRSHLD PNL	22-10-02
TRANSDUCER – LEFT INBOARD AILERON DUAL POSITION	2	L WING/551AB	22-13-03
UNIT – VHF NAVIGATION ACCESSORY	1	FESC, REAR RACK/112AB	34-55-06

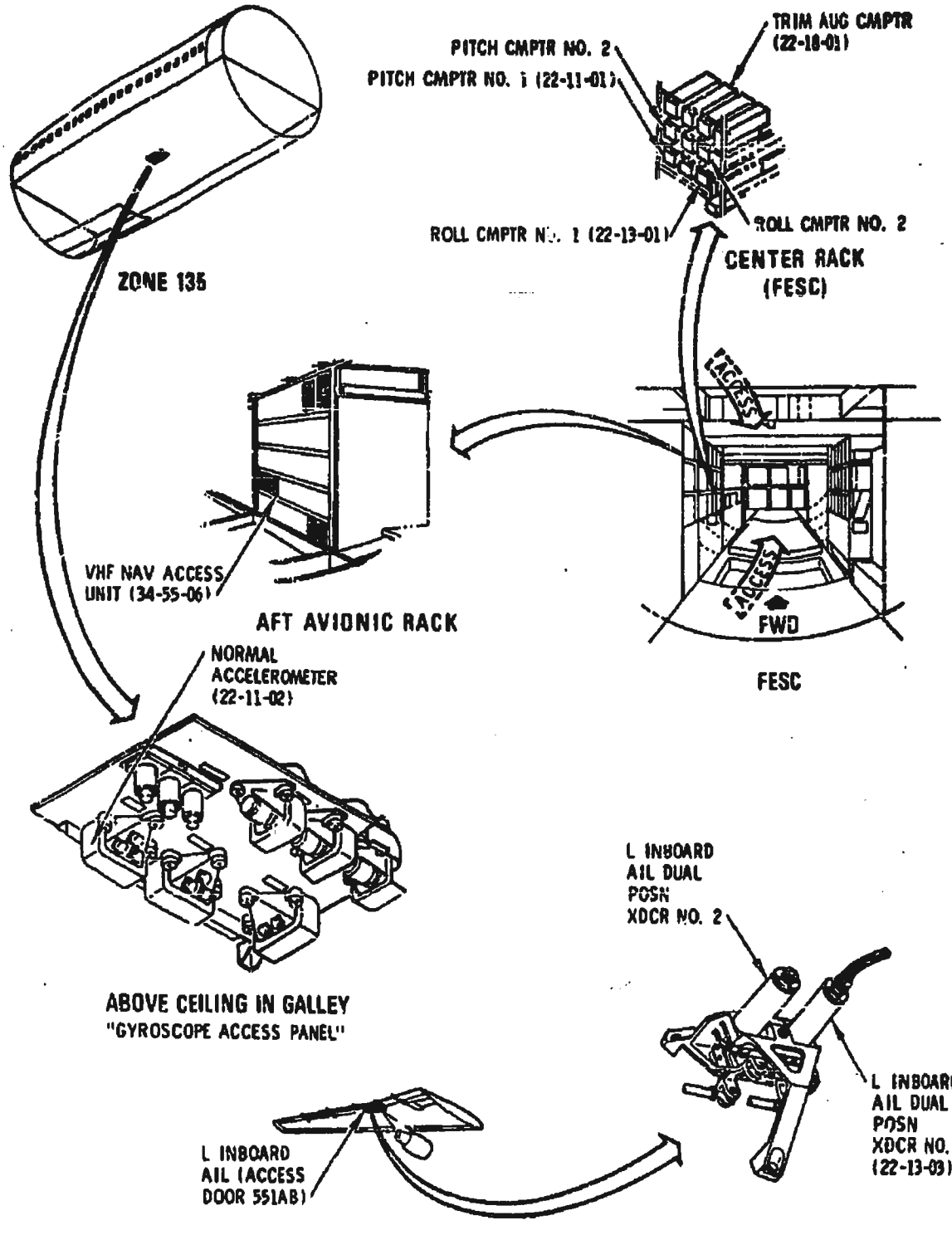
M1-0000-22-2194

Component Location Index
Figure 101

R EFFECTIVITY: ALL
R
001B



Component Locator Diagram
Figure 102 (Sheet 1)



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Component Locator Diagram
Figure 102 (Sheet 2)

(6) On NAV MODE panel, depress APR switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM and GS ARM messages are displayed.

(7) Using ILS test set, establish zero LOC deviation on HSI.

RESULT:

On both AFCS MODES annunciators, LOC ARM messages change to LOC within 15 seconds.

On both ADIs, FD flags are out of view, and command bars are centered and level within 15 seconds.

On both AFCS WARNING indicators, NO ALIGN messages are displayed after 1 minute.

(8) On NAV MODE panel, rapidly rotate left COURSE knob clockwise approximately 40 degrees from aircraft heading.

RESULT:

On Capt ADI, command bar commands right roll and starts to return to level within 15 seconds.

(9) On NAV MODE panel, rapidly rotate right COURSE knob clockwise approximately 40 degrees from aircraft heading.

RESULT:

On F/O ADI, command bar commands right roll and starts to return to level within 15 seconds.

(10) On NAV MODE panel, set both COURSE knobs back to aircraft heading.

(11) Using ILS test set, establish zero GS deviation on HSI.

RESULT:

On both AFCS MODES annunciators, GS ARM messages change to GS.

On both ADIs, command bars are centered, and approach gates come into view within one minute.

(12) Using ILS test set, slowly increase LOC deviation for a 1-dot steer-right indication on both HSIs.

RESULT:

On both ADIs, approach gate moves to right, and command bars command right roll within 15 seconds.

(13) On radio altitude test set, decrease radio altitude to 140 feet as indicated on both radio altimeter indicators.

RESULT:

On both AFCS WARNING indicators, NO FLARE messages are displayed.

(14) Using ILS test set, slowly increase GS deviation for a 1-dot steer-up indication on both HSIs.

RESULT:

On both ADIs, approach gate moves up, and command bars command nose up.

(15) On NAV MODE panel, depress APR switchlight to off.

(16) Using ILS test set, establish zero LOC and GS deviations on HSI.

(17) On NAV MODE panel, depress APR switchlight to on.

RESULT:

On both APFDS MODES annunciators, LOC ARM and GS ARM messages are displayed, and then change to LOC and GS.

(18) On CB1, open ILS (G4) and (G22) circuit breakers.

RESULT:

On both ADIs, FD flags are displayed, and command bars and approach gates are removed from view.

(19) Close G4 and G22 circuit breakers. Set both FD switches to OFF, then ON.

RESULT:

On both ADIs, FD flags are removed from view and command bars and approach gates come into view.

(20) On galley ceiling zone 135, carefully remove lateral accelerometer from ceiling with cables connected, and rotate approximately 90 degrees in right-roll direction.

RESULT:

On both ADIs, command bars command left roll.

(21) Re-install lateral accelerometers.

(22) On galley ceiling zone 135, carefully remove normal accelerometer from ceiling with cables connected, and tilt normal accelerometer approximately 90 degrees in nose down direction.

RESULT:

On both ADIs, command bars command nose up.

R (23) Re-install normal accelerometers.

R NOTE: Steps 4B(24) thru 4B(33) apply to aircraft with
R vertical gyros installed.

(24) On CB1, open INSTR CMPRN MON PWR (D8) and (D26) circuit breakers.

(25) In forward electronics service center (FESC), carefully remove vertical gyro No. 1 out of mount with cables connected, and rapidly tilt to approximately 10 degrees nose-up attitude.

RESULT:

On Capt ADI, command bar commands nose down, and starts to move toward center within 1 minute.

(26) Carefully level vertical gyro No. 1.

(27) Tilt vertical gyro No. 1 to a 10-degree right-roll attitude.

RESULT:

On Capt ADI, command bar commands left roll.

(28) Re-install vertical gyro No. 1 in mount.

(29) In FESC, carefully remove vertical gyro No. 2 out of mount with cables connected, and rapidly tilt to approximately 10 degrees nose-up attitude.

RESULT:

On F/O ADI, command bar commands nose down, and starts to move towards center within 1 minute.

(30) Carefully level vertical gyro No. 2.

(31) Tilt vertical gyro No. 2 to a 10-degree right-roll attitude.

RESULT:

On F/O ADI, command bar commands left roll.

(32) Re-install vertical gyro No. 2 in mount.

(33) Close D8 and D26 circuit breakers.

NOTE: Steps 4B(34) thru 4B(44) apply to aircraft with inertials installed.

(34) Verify all appropriate Inertial System circuit breakers are open.

(35) Locate Test Set G/ITEL 34-21-78 in flight station. Route Test Set cables through floor hatch to FESC forward rack, lower shelf and connect in lieu of Inertial units (Ref. 34-21-00,201 Maintenance Practices).

(36) On Test Set, position each of the 9 synchros to 0° and SYSTEM FLAG switch S1 to position 3, FLAG switch S2 to ON and switch S3 to DELCO.

(37) On Test Set, position SYS NO. 1 PITCH Synchro to approximately 10 degrees nose-up attitude.

RESULT:

On Capt ADI, command bar commands nose down, and starts to move toward center within 1 minute.

(38) Position SYS NO. 1 PITCH Synchro to 0 degrees.

(39) On Test Set, position SYS NO. 1 ROLL Synchro to approximately 10 degrees right roll attitude.

RESULT:

On Capt ADI, command bar commands left roll.

R (40) On Test Set, position SYS NO. 2 PITCH Synchro to approximately 10 degrees nose-up attitude.

RESULT:

On F/O ADI, command bar commands nose down, and starts to move towards center within 1 minute.

(41) Position SYS NO. 2 PITCH Synchro to 0 degrees.

(42) On Test Set, position SYS NO. 2 ROLL Synchro to approximately 10 degrees right roll attitude.

RESULT:

On F/O ADI, command bar commands left roll.

R (43) Disconnect Test Set from FESC forward rack and
R re-install inertial units.

R (44) Connect air data tester to CADC systems No. 1 and 2.
R Rapidly establish an altitude rate of approximately
R 2000 (up) FPM. On both ADIs, command bars move down
R and then start to move towards center within 1 minute.

R (45) Return air data tester to ambient altitude.

R (46) On APFDS ENGAGE panel, set FD A and B switches to OFF.

5. Fault Isolation

A. General

Table 101 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 102. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

FD Approach Mode Fault Isolation Summary
Table 101

TEST REF.	FAULT	FAULT NO.
4B(1)	ADI fault indication	(1)
4B(6)-1	APR switchlight not illuminated	(2)
4B(6)-2	LOC ARM message not displayed on Capt AFCS MODES annunciator	(3)
4B(6)-3	GS ARM message not displayed on Capt AFCS MODES	(4)
4B(6)-4	LOC ARM message not displayed on F/O AFCS MODES annunciator	(5)
4B(6)-5	GS ARM message not displayed on F/O AFCS MODES annunciator	(6)
4B(7)-1	LOC message not displayed on Capt AFCS MODES annunciator	(7)
4B(7)-2	LOC message not displayed on F/O AFCS MODES annunciator	3B(7) (a)-2(8)
4B(7)-3	FD flag displayed on Capt ADI	(9)
4B(7)-4	Command bar is not level on Capt ADI	(10)
4B(7)-5	FD flag displayed on F/O ADI	(11)
4B(7)-6	Command bar is not level on F/O ADI	(12)

FD Approach Mode Fault Isolation Summary (Cont)
Table 101

TEST REF.	FAULT	FAULT NO.
4B(7)-7	NO ALIGN message not displayed on Capt AFCS WARNING indicator	(13)
4B(7)-8	NO ALIGN message not displayed on F/O AFCS WARNING indicator	(14)
4B(8)-1	Command bar does not move on Capt ADI	(15)
4B(8)-2	Command bar does not level on Capt ADI	(16)
4B(9)-1	Command bar does not move on F/O ADI	(17)
4B(9)-2	Command bar does not level on F/O ADI	(18)
4B(11)-1	GS capture message not displayed on Capt AFCS MODES annunciator	(19)
4B(11)-2	GS capture message not displayed on F/O AFCS MODES annunciator	(20)
4B(11)-3	Command bar not centered on Capt ADI	(21)
4B(11)-4	Approach gate not centered on Capt ADI	(22)
4B(11)-5	Command bar not centered on F/O ADI	(23)
4B(11)-6	Approach gate not centered on F/O ADI	(24)
4B(12)-1	Command bar does not move on Capt ADI	(25)
4B(12)-2	Approach gate does not move on Capt ADI	(26)
4B(12)-3	Command bar does not move on F/O ADI	(27)
4B(12)-4	Approach gate does not move on F/O ADI	(28)
4B(13)-1	NO FLARE message not displayed on Capt AFCS WARNING indicator	(29)
4B(13)-2	NO FLARE message not displayed on F/O AFCS WARNING indicator	(30)
4B(14)-1	Command bar does not move on Capt ADI	(30)
4B(14)-2	Approach gate does not move on Capt ADI	(32)

FD Approach Mode Fault Isolation Summary (Cont)
Table 101

TEST REF.	FAULT	FAULT NO.
4B(14)-3	Command bar does not move on F/O ADI	(33)
4B(14)-4	Approach gate does not move on F/O ADI	(34)
4B(15)	APR switchlight remains illuminated	(35)
4B(18)-1	FD flag not displayed on Capt ADI	(36)
4B(18)-2	Approach gate remains in view on Capt ADI	(37)
4B(18)-3	FD flag not displayed on F/O ADI	(38)
4B(18)-4	Approach gate remains in view on F/O ADI	(39)
4B(20)-1	Command bar does not move on Capt ADI	(40)
4B(20)-2	Command bar does not move on F/O ADI	(41)
4B(22)-1	Command bar does not move on Capt ADI	(42)
4B(22)-2	Command bar does not move on F/O ADI	(43)
4B(25)	Command bar motion incorrect on Capt ADI	(44)
4B(27)	Command bar does not move on Capt ADI	(45)
4B(29)	Command bar motion incorrect on F/O ADI	(46)
4B(31)	Command bar does not move on F/O ADI	(47)
4B(34)-1	Command bar motion incorrect on Capt ADI	(48)
4B(34)-2	COMMAND bar motion incorrect on F/O ADI	(49)

Schematics for Fault Isolation of FD Approach Mode Problem
Table 102

TITLE	LOCATION
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5

Schematics for Fault Isolation of FD Approach Mode Problem (Cont)
Table 102

TITLE	LOCATION
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
Glide Slope Capture, Track, Approach Land, and Flare Engage Logic Schematic	22-11-00, Schem 15
Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic	22-13-00, Schem 5
Roll Systems No. 1 and No. 2 AUTOLAND Mode Signal Flow Schematic	22-13-00, Schem 6
A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7

B. FD Approach Mode

(1) Fault: ADI Fault Indication

(a) Perform Steps (1) and (2) of FD basic mode test R procedure (Ref. 22-10-31).

---

(2) Fault: APR Switchlight Not Illuminated

(a) Can lamp test procedure (Ref. 22-02-01) be performed with no indicated APR switchlight fault?

Yes: Replace NAV MODE panel (Ref. 22-10-02).

No: Perform lamp fault isolation procedure (Ref. 22-02-01).

---

(3) Fault: On Capt AFCS MODES Annunciator, LOC ARM Message Not Displayed

(a) On Capt AFCS MODES annunciator, is LOC message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 2 SYSTEMS PITCH & ROLL (A24) circuit breaker. Set FD switch A to ON. Depress APR switchlight to on. On Capt AFCS MODES annunciator, is LOC message displayed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated LOC ARM message fault?

Yes: Replace roll computer No. 1 (Ref.Ref. 22-13-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciator fault isolation procedure (Ref. 22-02-01).

---

(4) Fault: On Capt AFCS MODES Annunciator, GS ARM Message Not Displayed

(a) On Capt AFCS MODES Annunciator, is GS message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 2 SYSTEMS PITCH & ROLL (A24) circuit breaker. Set FD switch A to ON. Depress APR switchlight to on. On Capt AFCS MODES annunciator, is GS message displayed?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated GS ARM message fault?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace roll computer No. 1 (Ref. 22-13-01). If problem still persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciator fault isolation procedure (Ref. 22-02-01).

(5) Fault: On F/O AFCS MODES Annunciator, LOC ARM Message Not Displayed

(a) On F/O AFCS MODES annunciator, is LOC message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 1 SYSTEMS PITCH & ROLL (A6) circuit breaker. Set FD switch B to ON. Depress APR switchlight to on. On F/O AFCS MODES annunciator, is LOC message displayed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated LOC ARM message fault?

Yes: Replace roll computer No. 2 (Ref. 22-02-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciator fault isolation procedure (Ref. 22-02-01).

(6) Fault: On F/O AFCS MODES Annunciator, GS ARM Message Not Displayed

(a) On F/O AFCS MODES Annunciator, is GS message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 1 SYSTEMS PITCH & ROLL (A6) circuit breaker. Set FD switch B to ON. Depress APR switchlight to ON. On F/O AFCS MODES annunciator, is GS message displayed?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated GS ARM message fault?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace roll computer No. 2 (Ref. 22-13-01). If problem still persists, replace F/O AFCS MODE annunciator (Ref. 22-10-05).

No: Perform mode annunciator fault isolation procedure (Ref. 22-02-01).

---

(7) Fault: On Capt AFCS MODES Annunciator, LOC Message Not Displayed

(a) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indication LOC message fault?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciator press-to-test procedure (Ref. 22-02-01) fault isolation procedure.

---

(8) Fault: On F/O AFCS MODES Annunciator, LOC Message Not Displayed

(a) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated LOC message fault?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciator fault isolation procedure (Ref. 22-02-01).

---

(9) Fault: On Capt ADI, FD Flag Displayed

(a) On Capt HSI, is NAV flag displayed?

Yes: ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(10) Fault: On Capt ADI, FD Command Bar Is Not Level

R (a) Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(11) Fault: On F/O ADI, FD Flag Displayed

(a) On F/O HSI, is NAV flag displayed?

Yes: ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(12) Fault: On F/O ADI, FD Command Bar Is Not Level

R (a) Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(13) Fault: On Capt AFCS WARNING Indicator, NO ALIGN Message Not Displayed

(a) Replace Capt AFCS WARNING indicator (Ref. 22-10-06).

---

(14) Fault: On F/O AFCS WARNING Indicator, NO ALIGN Message Not Displayed

(a) Replace F/O AFCS WARNING indicator (Ref. 22-10-06).

---

(15) Fault: On Capt ADI, Command Bar Does Not Move

(a) Can Steps (1) through (5) of FD heading select
R mode test procedure (Ref. 22-13-31) be performed with no indicated fault?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace VHF NAV accessory unit (Ref. 34-55-06). If problem still persists, replace NAV MODE panel (Ref. 22-10-02).

No: Perform FD heading select mode fault isolation (Ref. 22-13-31).

---

(16) Fault: On Capt ADI, Command Bar Does Not Level

(a) Replace roll computer No. 1 (Ref. 22-13-01).

---

(17) Fault: On F/O ADI, Command Bar Does Not Move

(a) Can Steps (1) through (5) of FD heading select mode test procedure (Ref. 22-13-31) be performed with no indicated fault?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace VHF NAV accessory unit (Ref. 34-55-06). If problem persists, replace NAV MODE panel (Ref. 22-10-02).

No: Perform FD heading select mode fault isolation (Ref. 22-13-31).

---

(18) Fault: On F/O ADI, Command Bar Does Not Level

(a) Replace roll computer No. 2 (Ref. 22-13-01).

---

(19) Fault: On Capt AFCS MODES annunciator, GS Capture Message Not Displayed

(a) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no GS message fault?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciation fault isolation (Ref. 22-02-01).

---

(20) Fault: On F/O AFCS MODES Annunciator, GS Capture Message Not Displayed

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no GS message fault.

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace AFCS MODES annunciator (Ref. 22-10-05).

No: Perform mode annunciation fault isolation (Ref. 22-02-01).

---

(21) Fault: On Capt ADI, Command Bar Not Centered

(a) Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(22) Fault: On Capt ADI, Approach Gate Not Centered

(a) Replace Capt ADI (Ref. 34-21-07). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(23) Fault: On F/O ADI, Command Bar Not Centered

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(24) Fault: On F/O ADI, Approach Gate Not Centered

(a) Replace F/O ADI, (Ref. 34-21-07). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation.

(25) Fault: On Capt ADI, Command Bar Does Not Move

(a) Replace roll computer No. 1 (Ref. 22-13-01).

(26) Fault: On Capt ADI, Approach Gate Does Not Move

(a) Replace Capt ADI (Ref. 34-21-07). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(27) Fault: On F/O ADI, Command Bar Does Not Move

(a) Replace roll computer No. 2 (Ref. 22-13-01).

(28) Fault: On F/O ADI, Approach Gate Does Not Move

(a) Replace F/O ADI (Ref. 34-21-07). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(29) Fault: On Capt AFCS WARNING Indicator, NO FLARE Message Not Displayed

(a) Replace Capt AFCS WARNING indicator (22-10-06).

(30) Fault: On F/O AFCS WARNING Indicator, NO FLARE Message Not Displayed

(a) Replace F/O AFCS WARNING indicator (22-10-06).

(31) Fault: On Capt ADI, Command Bar Does Not Move

R (a) Can Steps (1) through (4) of FD Vertical Speed mode test procedure (Ref. 22-11-31) be performed with no indicated fault?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Perform FD Vertical Speed Mode fault isolation (Ref. 22-11-31).

(32) Fault: On Capt ADI, Approach Gate Does Not Move

(a) Replace Capt ADI (Ref. 34-21-07). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(33) Fault: On F/O ADI, Command Bar Does Not Move

(a) Can Steps (1) through (4) of FD Vertical Speed mode (Ref. 22-11-31) be performed with no indicated fault?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Perform FD vertical speed mode fault isolation (Ref. 22-11-31).

(34) Fault: On F/O ADI, Approach Gate Does Not Move

(a) Replace F/O ADI (Ref. 34-21-07). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(35) Fault: On NAV MODE panel, APR Switchlight Remains Illuminated

(a) Is LOC message displayed on Capt AFCS MODES annunciator?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If trouble persists, replace NAV MODE panel (Ref. 22-10-02).

No: Replace roll computer No. 2 (Ref. 22-13-01). If trouble persists, replace NAV MODE panel (Ref. 22-10-02).

---

(36) Fault: On Capt ADI, FD Flag Not Displayed

(a) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. On Capt ADI, is FD flag displayed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Replace Capt ADI (Ref. 34-21-07).

---

(37) Fault: On Capt ADI, Approach Gate Remains in View

(a) Replace roll computer No. 1 (Ref. 22-13-01). If trouble persists, replace Capt ADI (Ref. 34-21-07).

---

(38) Fault: On F/O ADI, FD Flag Not Displayed

(a) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. On F/O ADI, is FD flag displayed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace F/O ADI (Ref. 34-21-07).

---

(39) Fault: On F/O ADI, Approach Gate Remains in View

(a) Replace roll computer No. 2 (Ref. 22-13-01). If trouble persists, replace F/O ADI (Ref. 34-21-07).

---

(40) Fault: On Capt ADI, Command Bar Does Not Move

(a) Replace roll computer No. 1 (Ref. 22-13-01). If problem persists replace lateral accelerometer unit (Ref. 22-13-02).

---

(41) Fault: On F/O ADI, Command Bar Does Not Move

(a) Replace roll computer No. 2 (Ref. 22-13-01). If problem persists replace lateral accelerometer unit (Ref. 22-13-02).

---

(42) Fault: On Capt ADI, Command Bar Does Not Move

(a) Replace pitch computer No. 1 (Ref. 22-11-01). If trouble persists, replace normal accelerometer unit (Ref. 22-11-02). If trouble still persists, replace trim augmentation computer (Ref. 22-18-01).

---

(43) Fault: On F/O ADI, Command Bar Does Not Move

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If trouble persists, replace normal accelerometer unit (ref. 22-11-02). If trouble still persists, replace trim augmentation computer

---

(44) Fault: On Capt ADI, Command Bar Motion Incorrect

(a) On Capt ADI, does command bar command nose down?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Go to Step (b).

(b) On Capt ADI, is ATT flag displayed?

Yes: Vertical gyro No. 1 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Go to Step (c).

(c) On Capt ADI, does artifical horizon indicate pitch attitude of tilted gyro.

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If trouble persists, vertical gyro No. 1 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Vertical gyro No. 1 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

---

(45) Fault: On Capt ADI, Command Bar Does Not Move

(a) On Capt ADI, is ATTD flag displayed?

Yes: Vertical gyro No. 1 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Go to Step (b).

(b) On Capt ADI, does artifical horizon indicate roll altitude of tilted gyro?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If trouble persists, vertical gyro No. 1 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Vertical gyro No. 1 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

---

(46) Fault: On F/O ADI, Command Bar Motion Incorrect

(a) On F/O ADI, does command bar command nose down?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Go to Step (b).

(b) On F/O ADI, is ATT flag displayed?

Yes: Vertical gyro No. 2 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Go to Step (c).

(c) On F/O ADI, does artifical horizon indicate pitch attitude of tilted gyro?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If trouble persists, vertical gyro No. 2 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Vertical gyro No. 2 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

---

(47) Fault: On F/O ADI, Command Bar Does Not Move

(a) On F/O ADI, is ATT flag displayed?

Yes: Vertical gyro No. 2 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Go to Step (b).

(b) On F/O ADI, does artifical horizon indicate roll attitude of tilted gyro?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If trouble persists, vertical gyro No. 2 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

No: Vertical gyro No. 2 is suspected of being faulty (Ref. 34-21-00 for fault isolation).

---

(48) Fault: On Capt ADI, Command Bar Motion Incorrect

(a) Replace pitch computer No. 1 (Ref. 22-11-01). If trouble persists, ADC system No. 1 is suspected of being faulty (Ref. 34-14-00 for fault isolation).

(49) Fault: On F/O ADI, Command Bar Motion Incorrect

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If trouble persists, ADC system No. 2 is suspected of being faulty (Ref. 34-14-00 for fault isolation).

R # TAKEOFF MODE - FAULT ISOLATION

R 1. General

R The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for appropriate fault isolation. Figure 101 and 102 provide component location for Takeoff Mode troubleshooting.

R 2. Equipment and Materials

R None

R 3. Referenced Procedures

R	22-10-31	FD Basic Mode - Fault Isolation
R	22-10-33	Autopilot A CWS/CMD Mode - Fault Isolation
R	22-10-35	Autopilot B CWS/CMD Mode - Fault Isolation
R	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-15-00	YAW SAS System - Fault Isolation
R	22-17-00	Flight Control Electronics System - Fault Isolation
R	22-18-00	Trim Augmentation System - Fault Isolation
R	22-31-00	Speed Control System - Fault Isolation

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Perform flight director and autopilot setup procedures, Paragraphs 4A and 4B respectively of 22-12-00, maintenance practices.

R NOTE: Before applying hydraulics, ensure that the DLC/AUTO SPLR 1 and 2 switchlights (on FCES panel) are in the OFF (un-detented) position.

R (2) On both VHF NAV panel frequency selectors, select local VOR frequency.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AP	22-13-01
COMPUTER – SPEED CONTROL	2	FESC, CTR RACK/112AB	22-31-07
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT & F/O INSTR PNL	22-10-05
SWITCH–GO AROUND	2	FLT STA, CONTROL WHEEL	22-10-22
WHEEL – CONTROL	2	FLT STA	27-11-01

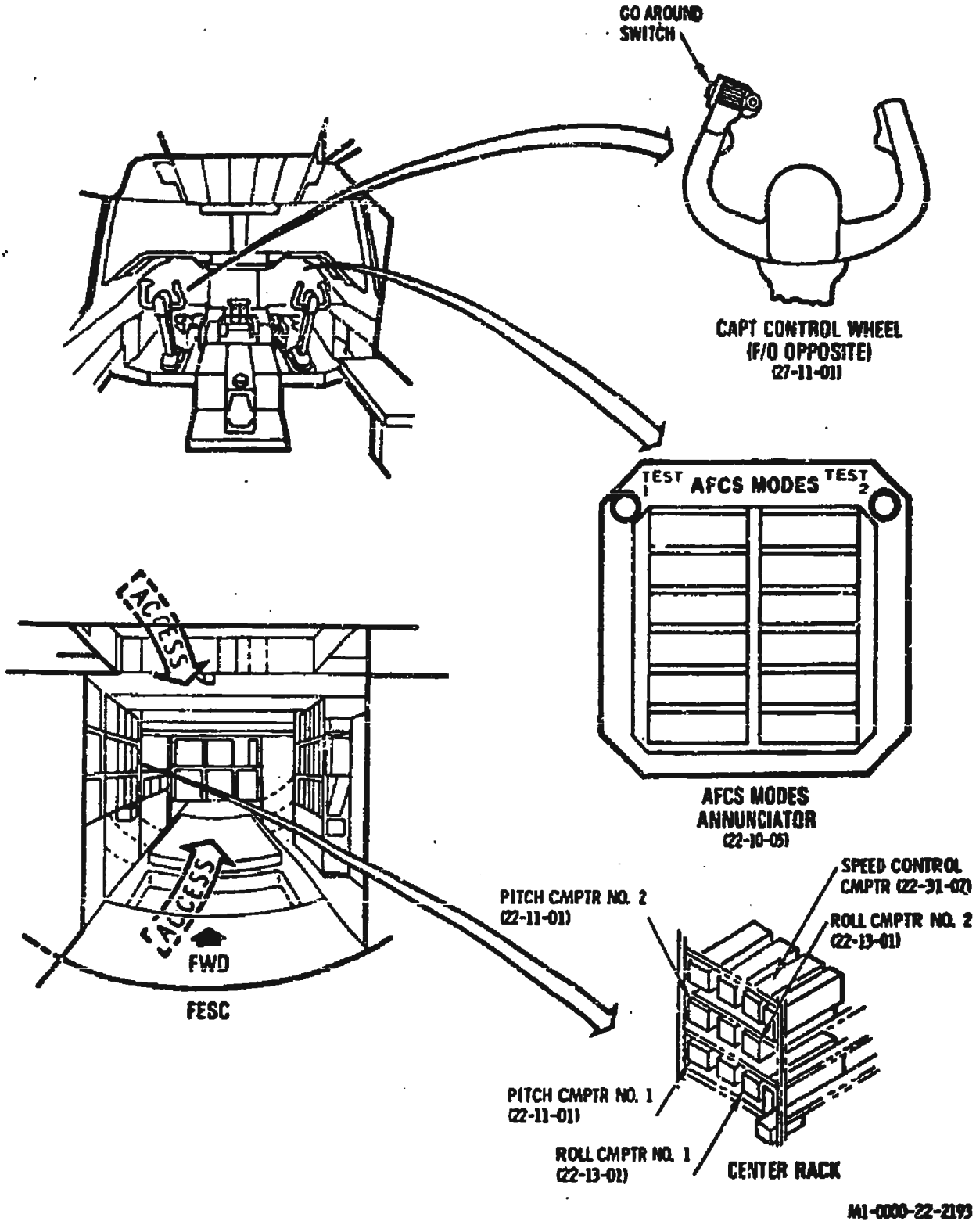
M1–0000–22–2192

R
R

Component Location Index
Figure 101

EFFECTIVITY: ALL

001B



R
R

Component Locator Diagram
Figure 102

EFFECTIVITY: ALL

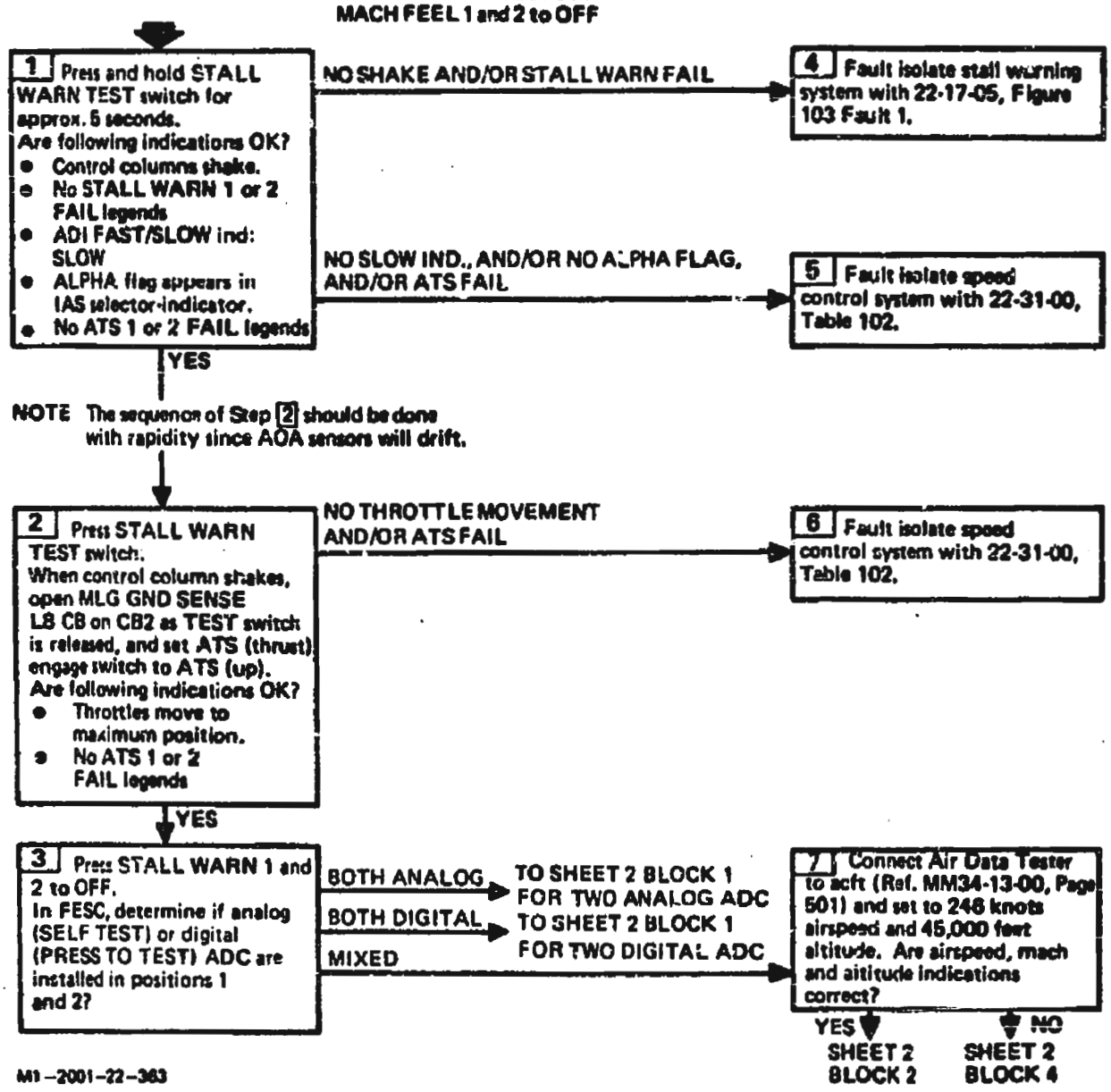
0018

R (3) On FCES panel:

R (a) Cycle PITCH TRIM 1 and 2 switchlights OFF and then
R on. If PITCH TRIM switch lights indicate FAIL,
R fault isolate pitch trim system (Ref. 22-18-00,
R Table 102).

R (b) Cycle YAW SAS 1 and 2 switchlights OFF and then
R on. If YAW SAS switchlights indicate FAIL, fault
R isolate YAW SAS system (Ref. 22-15-00, 103).

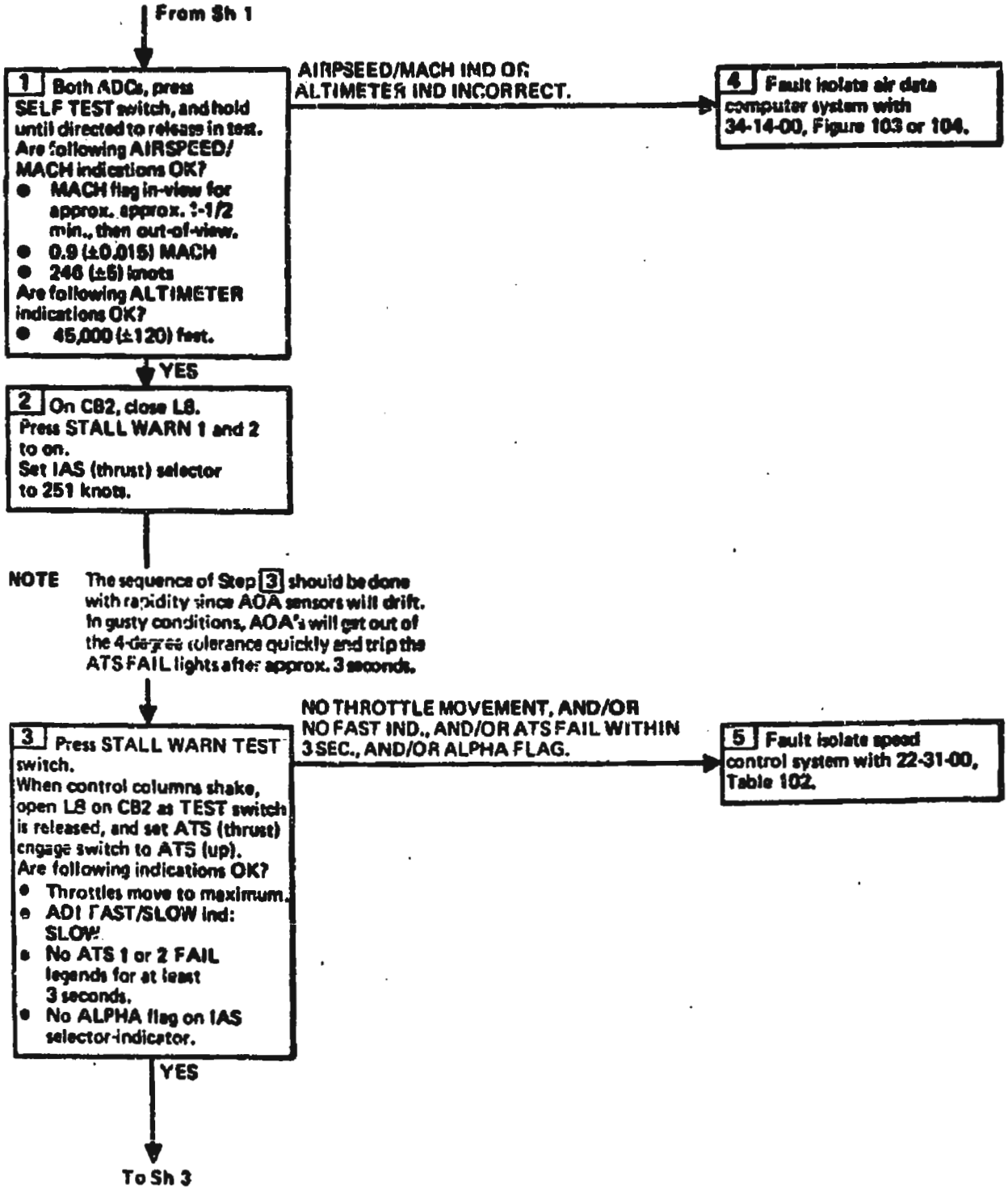
R (4) Perform speed control system check as detailed in
R Figure 103. Do not progress further into this test
R unless the SCS passes the requirements of the speed
R control system check.


PREREQUISITES
AFCS/MLG Accessory Unit Installed
STALL WARN 1 and 2 to on
On CB2, open H12 and H20 CB
DLC/AUTO SPLR 1 and 2 to OFF,
then turn HYDRO on
PITCH TRIM 1 and 2 to OFF
Flaps to zero deg.
ATS 1 and 2 to on
MACH TRIM 1 and 2 to OFF
MACH FEEL 1 and 2 to OFF
1 Press and hold STALL WARN TEST switch for approx. 5 seconds.
Are following indications OK?
• Control columns shake.
• No STALL WARN 1 or 2 FAIL legends
• ADI FAST/SLOW ind: SLOW
• ALPHA flag appears in IAS selector-indicator.
• No ATS 1 or 2 FAIL legends
NO SHAKE AND/OR STALL WARN FAIL
4 Fault isolate stall warning system with 22-17-05, Figure 103 Fault 1.
NO SLOW IND., AND/OR NO ALPHA FLAG, AND/OR ATS FAIL
5 Fault isolate speed control system with 22-31-00, Table 102.
YES
NOTE The sequence of Step 2 should be done with rapidity since AOA sensors will drift.
2 Press STALL WARN TEST switch.
When control column shakes, open MLG GND SENSE LB CB on CB2 as TEST switch is released, and set ATS (thrust) engage switch to ATS (up).
Are following indications OK?
• Throttles move to maximum position.
• No ATS 1 or 2 FAIL legends
NO THROTTLE MOVEMENT AND/OR ATS FAIL
6 Fault isolate speed control system with 22-31-00, Table 102.
YES
3 Press STALL WARN 1 and 2 to OFF.
In FESC, determine if analog (SELF TEST) or digital (PRESS TO TEST) ADC are installed in positions 1 and 2?
BOTH ANALOG
TO SHEET 2 BLOCK 1 FOR TWO ANALOG ADC
BOTH DIGITAL
TO SHEET 2 BLOCK 1 FOR TWO DIGITAL ADC
MIXED
7 Connect Air Data Tester to acft (Ref. MM34-13-00, Page 501) and set to 246 knots airspeed and 45,000 feet altitude. Are airspeed, mach and altitude indications correct?
YES
SHEET 2 BLOCK 2
NO
SHEET 2 BLOCK 4
M1-2001-22-363

R Speed Control System Fault Problem
R Figure 103 (Sheet 1)

EFFECTIVITY: ALL

001B

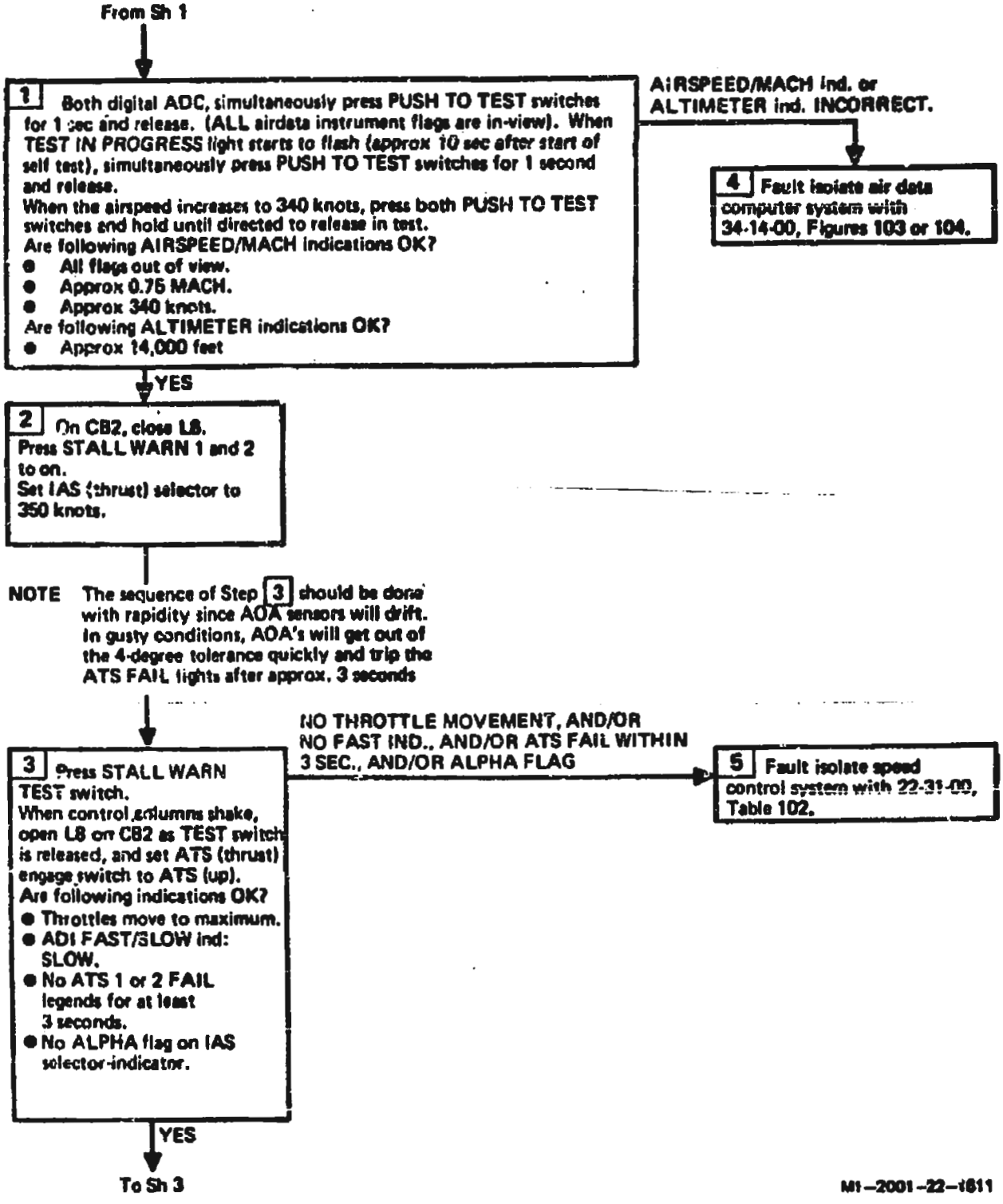

From Sh 1
1 Both ADCs, press SELF TEST switch, and hold until directed to release in test. Are following AIRSPEED/ MACH indications OK?
• MACH flag in-view for approx. approx. 1-1/2 min., then out-of-view.
• 0.9 (±0.015) MACH
• 246 (±6) knots
Are following ALTIMETER indications OK?
• 45,000 (±120) feet.
AIRPSEED/MACH IND OR ALTIMETER IND INCORRECT.
4 Fault isolate air data computer system with 34-14-00, Figure 103 or 104.
YES
2 On CB2, close L8. Press STALL WARN 1 and 2 to on. Set IAS (thrust) selector to 251 knots.
NOTE The sequence of Step 3 should be done with rapidity since AOA sensors will drift. In gusty conditions, AOA's will get out of the 4-degree tolerance quickly and trip the ATS FAIL lights after approx. 3 seconds.
3 Press STALL WARN TEST switch. When control columns shake, open L8 on CB2 as TEST switch is released, and set ATS (thrust) engage switch to ATS (up). Are following indications OK?
• Throttles move to maximum.
• ADI FAST/SLOW ind: SLOW.
• No ATS 1 or 2 FAIL legends for at least 3 seconds.
• No ALPHA flag on IAS selector-indicator.
NO THROTTLE MOVEMENT, AND/OR NO FAST IND., AND/OR ATS FAIL WITHIN 3 SEC., AND/OR ALPHA FLAG.
5 Fault isolate speed control system with 22-31-00, Table 102.
YES
To Sh 3

M1-2001-22-384

R Speed Control System Fault Problem
R Figure 103 (Sheet 2)

EFFECTIVITY: WITH TWO ANALOG ADC

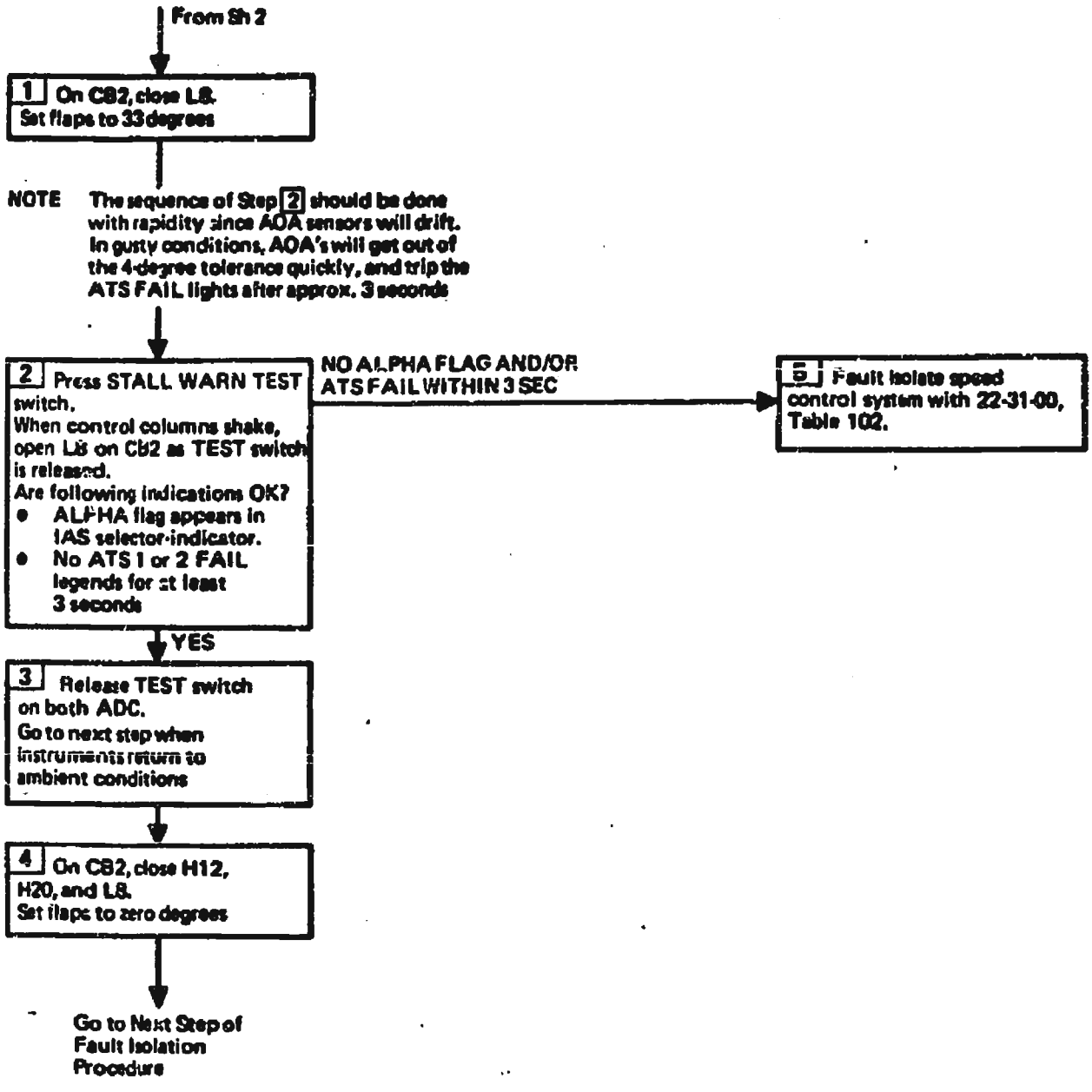
001B


From Sh 1
1 Both digital ADC, simultaneously press PUSH TO TEST switches for 1 sec and release. (ALL airdata instrument flags are in-view). When TEST IN PROGRESS light starts to flash (approx 10 sec after start of self test), simultaneously press PUSH TO TEST switches for 1 second and release.
When the airspeed increases to 340 knots, press both PUSH TO TEST switches and hold until directed to release in test.
Are following AIRSPEED/MACH indications OK?
● All flags out of view.
● Approx 0.75 MACH.
● Approx 340 knots.
Are following ALTIMETER indications OK?
● Approx 14,000 feet
AIRSPEED/MACH ind. or ALTIMETER ind. INCORRECT.
4 Fault isolate air data computer system with 34-14-00, Figures 103 or 104.
YES
2 On CB2, close L8.
Press STALL WARN 1 and 2 to on.
Set IAS (thrust) selector to 350 knots.
NOTE The sequence of Step 3 should be done with rapidity since AOA sensors will drift. In gusty conditions, AOA's will get out of the 4-degree tolerance quickly and trip the ATS FAIL lights after approx. 3 seconds
NO THROTTLE MOVEMENT, AND/OR NO FAST IND., AND/OR ATS FAIL WITHIN 3 SEC., AND/OR ALPHA FLAG
5 Fault isolate speed control system with 22-31-00, Table 102.
3 Press STALL WARN TEST switch.
When control columns shake, open L8 on CB2 as TEST switch is released, and set ATS (thrust) engage switch to ATS (up).
Are following indications OK?
● Throttles move to maximum.
● ADI FAST/SLOW ind: SLOW.
● No ATS 1 or 2 FAIL legends for at least 3 seconds.
● No ALPHA flag on IAS selector-indicator.
YES
To Sh 3

MI-2001-22-1811

R Speed Control System Fault Problem
R Figure 103 (Sheet 2)

EFFECTIVITY: WITH TWO DIGITAL ADC


From Sh 2
1 On CB2, close L8.
Set flaps to 33 degrees
NOTE The sequence of Step 2 should be done with rapidity since AOA sensors will drift. In gusty conditions, AOA's will get out of the 4-degree tolerance quickly, and trip the ATS FAIL lights after approx. 3 seconds
2 Press STALL WARN TEST switch.
When control columns shake, open L8 on CB2 as TEST switch is released.
Are following indications OK?
• ALPHA flag appears in IAS selector-indicator.
• No ATS 1 or 2 FAIL legends for at least 3 seconds
NO ALPHA FLAG AND/OR ATS FAIL WITHIN 3 SEC
5 Fault isolate speed control system with 22-31-00, Table 102.
YES
3 Release TEST switch on both ADC.
Go to next step when instruments return to ambient conditions
4 On CB2, close H12, H20, and L8.
Set flaps to zero degrees
Go to Next Step of Fault Isolation Procedure

M1-2001-22-366

R Speed Control System Fault Problem
R Figure 103 (Sheet 3)

EFFECTIVITY: ALL

0018

(5) Before proceeding, ensure that:

(a) AFCS/MLG accessory unit is installed.

(b) Flaps are retracted.

(c) Slats are not locked.

(d) On FCES panel, STALL WARN 1 and 2 switchlights are on.

(e) On APFDS ENGAGE panel, set FD switches A and B to ON. On both ADIs, command bars should be centered and level. If not fault isolate FD basic mode (Ref. 22-10-31, 103). Set FD A and B switches to OFF.

(f) On APFDS ENGAGE panel, set AP engage switch A to CMD. If unable to set to, or hold in CMD, fault isolate autopilot A CWS/CMD mode (Ref. 22-10-33, 103). Disengage autopilot A.

(g) On APFDS ENGAGE panel, set AP engage switch B to CMD. If unable to set to, or hold in CMD, fault isolate autopilot B CWS/CMD mode (Ref.22-10-35 103). Disengage autopilot B.

(h) On pilots overhead COMPASS panels, manually slew both compass systems to a heading approximately 10 degrees more than aircraft heading and then release slew switches.

NOTE: During slewing process ignore HSI HDG flags.

(i) On APFDS ENGAGE panel, set FD A and B switches to ON. On both ADI's command bars gradually command right roll as both compasses automatically slew back to aircraft heading. Wait until a right roll command is clearly discernable from a wings level command.

NOTE: If a right roll command is not obtained within five (5) minutes, fault isolate flight director heading hold mode (Ref. 22-10-31, 103).

B. Takeoff Mode Test

(1) On Capt control wheel, momentarily depress GO AROUND switch.

RESULT:

On both AFCS MODES annunciators, TAKEOFF message is displayed.

On both ADI's, command bars command wings level.

NOTE: Pitch command bar positioning is related to angle-of-attack probe positioning, and usually commands nose down.

(2) On FCES panel, depress STALL WARN TEST and hold (for approximately 30 secs.).

RESULT:

On both ADI's, command bars command nose-down.

(3) On APFDS ENGAGE panel, set FD A and B switches to OFF.

RESULT:

On both AFCS MODES annunciators, TAKEOFF message is removed.

On both ADI's, command bars are removed from view.

(4) On APFDS ENGAGE panel, set FD A and B switches to ON.

RESULT:

On both ADI's, command bars come into view and are centered and level.

(5) On F/O control wheel, momentarily depress GO AROUND switch.

RESULT:

On both AFCS MODES annunciators, TAKEOFF message is displayed.

(6) On APFDS ENGAGE panel, set autopilot engage switch A to CWS.

RESULT:

Autopilot engage switch A will set to, and remain in CWS.

NOTE: During the following tests, ignore any AP LIMIT warning messages.

(7) On Capt control wheel, slowly pull aft with increasing force until high resistance to further motion is felt.

RESULT:

AP engage switch A remains in CWS.

(8) Slowly release force.

(9) Slowly rotate Capt control wheel clockwise until high resistance to further motion is felt.

RESULT:

AP engage switch A remains in CWS.

(10) Slowly release force. If AP engage switch A drops to OFF, reset to CWS.

(11) On F/O control wheel, slowly push forward with increasing force until high resistance to further motion is felt.

RESULT:

AP engage switch A remains in CWS.

(12) Slowly release force.

(13) Slowly rotate F/O control wheel counter-clockwise until high resistance to further motion is felt.

RESULT:

AP engage switch A remains in CWS.

(14) Slowly release force. If AP engage switch A drops to OFF, do not reset to CWS.

(15) On APFDS ENGAGE panel, set autopilot engage switch B to CWS.

RESULT:

Autopilot engage switch B will set to, and remain in CWS.

(16) On F/O control wheel, slowly pull aft with increasing force until high resistance to further motion is felt.

RESULT:

AP engage switch B remains in CWS.

(17) Slowly release force.

(18) Slowly rotate F/O control wheel clockwise until high resistance to further motion is felt.

RESULT:

AP engage switch B remains in CWS.

(19) Slowly release force. If AP engage switch B drops to OFF, reset to CWS.

(20) On Capt control wheel, slowly push forward with increasing force until high resistance to further motion is felt.

RESULT:

AP engage switch B remains in CWS.

(21) Slowly release force.

(22) Slowly rotate Capt control wheel counter-clockwise until high resistance to further motion is felt.

RESULT:

AP engage switch B remains in CWS.

(23) Slowly release force. If AP engage switch B drops to OFF, do not reset to CWS.

(24) Disengage autopilot B and set FD A and B to OFF.

(25) Set flaps to 4 degrees.

(26) On APFDS ENGAGE panel, set FD A and B switches to ON.

RESULT:

On both ADI's, command bars come into view and are centered and level.

(27) On either control wheel, momentarily depress GO AROUND switch.

RESULT:

On both AFCS MODES annunciators, TAKEOFF message is displayed.

(28) Set flap handle to 0 degrees.

RESULT:

On both ADI's, FD flags, command bars, and FAST/SLOW indicators should not move in- and out-of-view.

(29) Set FD A and B to OFF.

5. Fault Isolation

A. General

Table 101 is a summary of Faults encountered when performing the Fault Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 102. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

Takeoff Mode Fault Isolation Summary
Table 101

TEST REF.	FAULT	FAULT NO.
4B(1)-1	No TAKEOFF message on Capt AFCS MODES ann when Capt GO AROUND switch is depressed.	(1)
4B(1)-2	No TAKEOFF message on F/O AFCS MODES ann when Capt GO AROUND switch is depressed.	(2)
4B(1)-3	On Capt ADI, command bar does not command wings level during takeoff mode.	(3)
4B(1)-4	On F/O ADI, command bar does not command wings level during takeoff mode.	(4)
4B(2)-1	On Capt ADI, command bar does not command nose-down during takeoff mode with STALL WARN TEST.	(5)
4B(2)-2	On F/O ADI, command bar does not command nose-down during takeoff mode with STALL WARN TEST.	(6)
4B(5)	On either Capt or F/O AFCS MODES ann, no TAKEOFF message, when F/O GO AROUND switch is depressed.	(7)
4B(6)	AP engage switch A can not be set to, or remain in, CWS during takeoff mode.	(8)

Takeoff Mode Fault Isolation Summary (Cont)
Table 101

	TEST REF.	FAULT	FAULT NO.
R R R	4B(7)	AP engage switch A drops to OFF, during takeoff mode when pitch forces are applied to Capt control wheel	(9)
R	4B(9)	AP engage switch A drops to OFF, during takeoff mode when roll forces are applied to Capt control wheel	(10)
	4B(11)	AP engage switch A drops to OFF, during takeoff mode, when pitch forces are applied to F/O control wheel	(11)
	4B(13)	AP engage switch A drops to OFF, during takeoff mode, when roll forces are applied to F/O control wheel.	(12)
	4B(15)	AP engage switch B will not set to, or remain in, CWS during takeoff mode.	(13)
	4B(16)	AP engage switch B drops to OFF, during takeoff mode, when pitch forces are applied to F/O control wheel.	(14)
	4B(18)	AP engage switch B drops to OFF, during takeoff mode, when roll forces are applied to F/O control wheel.	(15)
	4B(20)	AP engage switch B drops to OFF, during takeoff mode, when pitch forces are applied to Capt control wheel.	(16)
	4B(22)	AP engage switch B drops to OFF, during takeoff mode, when roll forces are applied to F/O control wheel.	(17)
	4B(28)	FD Flags, command bars, and FAST/SLOW indicators move in- and out-of-view, during takeoff mode, when flap handle is moved from 4-degree position to 0-degree position	(18)

Schematics for Fault Isolation of Takeoff Mode Problem
Table 102

TITLE	LOCATION
Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode Signal Flow Schematic	22-11-00, Schem 4
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 6
Takeoff/Go-Around Modes Engage Logic Schematic	22-11-00, Schem 12
A/L, LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7
Roll Servo Engage/Valid and Roll Valid Logic Schematic	22-13-00, Schem 10
Takeoff/Go-Around Signal Flow Schematic	22-31-00, Schem 3
Takeoff/Go-Around Mode Switching Logic Schematic	22-31-00, Schem 5
Takeoff/Go-Around Valid and No Go-Around Annunciation Logic Schematic	22-31-00, Schem 8

B. Takeoff Mode Faults

(1) Fault: On Capt AFCS MODES annunciator, no TAKEOFF message when Capt GO AROUND switch is depressed.

(a) Depress F/O GO AROUND switch. Does TAKEOFF message appear?

Yes: Replace Capt control wheel (Ref. 27-11-01).

NO: Go to step (b).

(b) On Capt AFCS MODES annunciator, depress TEST 2 switch. Does TAKEOFF message appear?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01)

No: Replace Capt AFCS MODES annunciator (Ref. 22-10-05).

---

(2) Fault: On F/O AFCS MODES annunciator, no TAKEOFF message when Capt GO AROUND switch is depressed.

(a) Depress F/O GO AROUND switch. Does TAKEOFF message appear?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Go to step (b).

(b) On F/O AFCS MODES annunciator, depress TEST 2 switch. Does TAKEOFF message appear?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace F/O AFCS MODES annunciator (Ref. 22-10-05).

(3) Fault: On Capt ADI, command bar does not command wings level during Takeoff mode.

(a) Is FD flag in view?

Yes: Go to step (b).

No: Replace roll computer No. 1 (Ref. 22-13-01). If failure persists, replace pitch computer No. 1 (Ref. 22-11-01).

(b) Is speed command pointer in view?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

---

(4) Fault: On F/O ADI, command bar does not command wings level during Takeoff Mode.

(a) Is FD flag in view?

Yes: Go to step (b).

No: Replace roll computer No. 2 (Ref. 22-13-01). If failure persists, replace pitch computer No. 2 (Ref. 22-11-01).

(b) Is speed command pointer in view?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

---

(5) Fault: On Capt ADI, command bar does not command nose-down during Takeoff mode with STALL WARN TEST.

On Capt ADI, does speed command pointer indicate slow?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

---

(6) Fault: On F/O ADI, command bar does not command nose-down during Takeoff mode with STALL WARN TEST.

On F/O ADI, does speed command pointer indicate slow?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

---

(7) Fault: On either (Capt or F/O) AFCS MODES annunciator, no TAKEOFF message when F/O GO AROUND switch is depressed. Replace F/O control wheel (Ref. 27-11-01).

---

(8) Fault: Autopilot engage switch A can not be set to, or remain in, CWS during Takeoff mode.

(a) Can autopilot engage switch B be set to and remain in CWS during Takeoff mode?

YES: Go to step (b).

No: Suspect problem with a control wheel steering force transducer. Fault isolate autopilot A CWS/CMD mode (Ref. 22-10-33, 103).

(b) Set FD A and B switches to OFF (resets Takeoff mode). Can autopilot engage switch A be set to and remain in CWS?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace roll computer No. 1 (Ref. 22-13-01).

No: Suspect basic autopilot A CWS engage problem. Fault isolate autopilot A CWS/CMD mode (Ref. 22-10-33, 103).

---

(9) Fault: AP engage switch A drops to OFF, during Takeoff mode, when pitch forces are applied to Capt control wheel.

Set AP engage switch A to CWS. Does autopilot A remain engaged while pitch forces are applied to F/O control wheel?

Yes: Replace Capt control wheel (Ref. 27-11-01).

R No: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2.

(10) Fault: AP engage switch A drops to OFF, during Takeoff mode, when roll forces are applied to Capt control wheel.

Set AP engage switch A to CWS. Does autopilot A remain engaged while roll forces are applied to F/O control wheel?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2.

---

(11) Fault: AP engage switch A drops to OFF, during Takeoff mode, when pitch forces are applied to F/O control wheel.

Replace F/O control wheel (Ref. 27-11-01).

---

(12) Fault: AP engage switch A drops to OFF, during Takeoff Mode, when roll forces are applied to F/O control wheel.

Replace F/O control wheel (Ref. 27-11-01).

---

(13) Fault: AP engage switch B will not set to, or remain in, CWS during Takeoff mode.

(a) Set FD A and B switches to OFF (resets Takeoff mode). Can autopilot engage switch B be set to and remain in CWS?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace roll computer No. 2 (Ref. 22-13-01).

No: Suspect basic autopilot B CWS engage problem. Fault isolate autopilot B CWS/CMD mode (Ref. 22-10-35, 103).

(14) Fault: AP engage switch B drops to OFF, during Takeoff mode, when pitch forces are applied to F/O control wheel.

Replace pitch computer No. 2 (Ref. 22-11-01). If fault persists, replace pitch computer No. 1.

(15) Fault: AP engage switch B drops to OFF, during Takeoff mode, when roll forces are applied to F/Os control wheel.

Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace roll computer No. 1.

(16) Fault: AP engage switch B drops to OFF, during Takeoff mode, when pitch forces are applied to Capt control wheel.

Replace pitch computer No. 2 (Ref. 22-11-01). If fault persists, replace pitch computer No. 1.

(17) Fault: AP engage switch B drops to OFF, during Takeoff mode, when roll forces are applied to F/O control wheel.

Replace roll computer No. 2 (Ref. 22-13-01). If fault persists, replace roll computer No. 1.

(18) Fault: FD flags, command bars, and FAST/SLOW indicators move in- and out-of-view, during takeoff mode, when flap handle is moved from 4-degree position to 0-degree position.

(a) Time flap movement from 4 degrees to 0 degrees (6 - 8 seconds is normal). Is time greater than 8 seconds?

Yes: Check Vane Lubrication (Ref. 12-23-20, Figure 302), check Wing Flap Lubrication (Ref. 12-23-20, Figure 303), and check Wing Flap Power Drive Unit Lubrication (Ref. 12-23-20, Figure

304). If fault persists, fault isolate flap system for slow movement (Ref. 27-51-00).

No: Replace speed control computer (Ref. 22-31-07).

DUAL A/L NOT AVAIL (DANA) - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting Dual A/L Not Avail (DANA) Light faults are included in this section of the manual. A DANA light malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use DANA Light Fault Matrix. Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the DANA light fault isolation diagrams and schematics. Figure 101 and 102 provide component location for DANA light troubleshooting.

A. General

DANA (DUAL A/L NOT AVAIL) fault isolation contains two levels of troubleshooting; (1) fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2B) troubleshoots a specific DANA problem. System oriented fault isolation (Ref. 22-12-37, Page 501) tests and troubleshoots DANA problems.

R

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the autoflight system by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-12-37, Page 501) to isolate problem.

Figures 104 and 105 provide diagnostic steps to further isolate the fault. Hard DANA is a DANA light that comes on

R immediately after AP bat handle is set to CWS or CMD from
R OFF. Soft DANA is a DANA light that comes on with an
R aircraft altitude, heading, or mode change. The diagnostic
R steps are in flow chart form which contains complete fault
R isolation procedures for each fault. Action instructions
R are contained within the blocks of the flow chart while the
R monitored results of the actions are outside the blocks.
R When using the flow charts, it is assumed that systems are
R in the normal operational mode, all relevant circuit
R breakers have been checked, and all applicable aircraft
R operational procedures have been accomplished.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCELEROMETER – LATERAL	1	GALLEY CLG/1350B	22-13-02
ACCELEROMETER – NORMAL	1	GALLEY CLG/1350B	22-11-02
COMPUTER – FLIGHT CONTROL ELECTRONICS SYSTEM	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – TRIM AUGMENTATION	1	FESC, CTR RACK/112AB	22-18-01
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
GYRO – YAW RATE	3	GALLEY CLG/1350B	22-15-02
GYRO – VERTICAL ATTITUDE REFERENCE ◁1▷	3	FESC, FWD RACK/112AB	34-21-04
PANEL – APFDS ENGAGE	1	FLT STA, GLRSHLD PNL	22-10-01
RECEIVER – ILS	2	FESC, REAR RACK/112AB	34-33-01
SERVO MODULE – RUDDER	1	VERT STAB/324AL, 324AR	27-21-07
SWITCH – AP A (B) HYD SYS B (A) HIGH AUTHORITY HOOK PRESSURE	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-09
SWITCH – AP A (B) HYD SYS B (A) PRESSURE	2	VERT STAB, ON RUD SERVO MDL/324AL, 324AR	27-21-24
TRANSDUCER – LEFT INBOARD AILERON DUAL POSITION	2	L WING/551AB	22-13-03
TRANSDUCER – RUDDER DUAL POSITION	2	VERT STAB/324CL, 325DL	22-15-03
TRANSMITTER/RECEIVER – RADIO ALTIMETER	2	MESC, L&R RACK/131AR	34-32-01
UNIT – INERTIAL ◁2▷	2	FESC, FWD RACK/112AB	34-43-03
VALVE – AP A (B) HYD SYS B (A) HIGH AUTHORITY HOOK ENGAGE SOLENOID SHUTOFF	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-07
VALVE – AP A (B) HYD SYS B (A) PRESSURE SHUTOFF	2	L WING, ON L INBD AIL SERVO/551BB	27-11-20

EFFECTIVITY

◁1▷ ON AIRCRAFT 001-024, 027

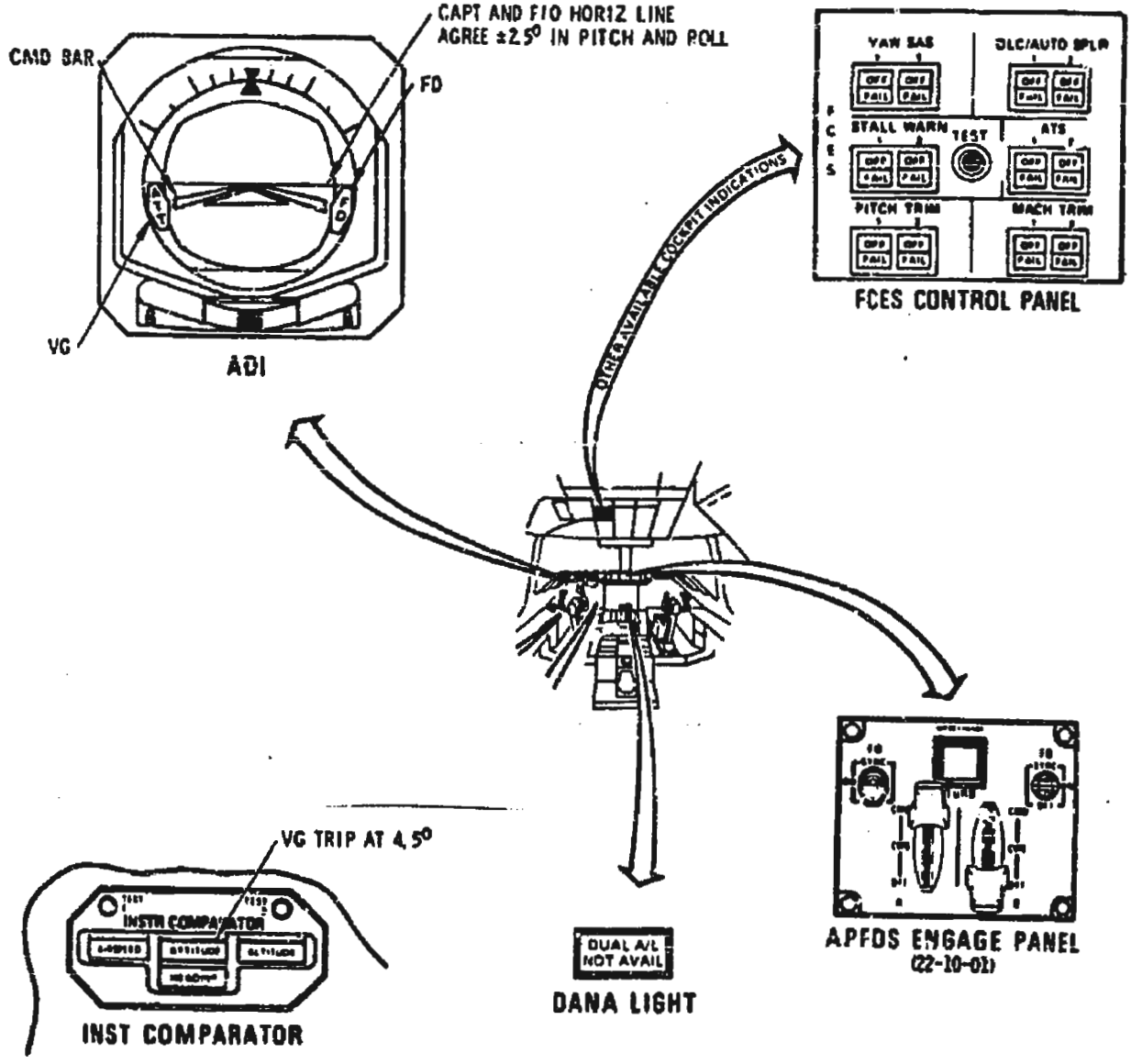
◁2▷ ON AIRCRAFT 025, 026, 028-699

M1-0000-22-2233

R R Component Location Index
Figure 101

EFFECTIVITY: ALL

001B



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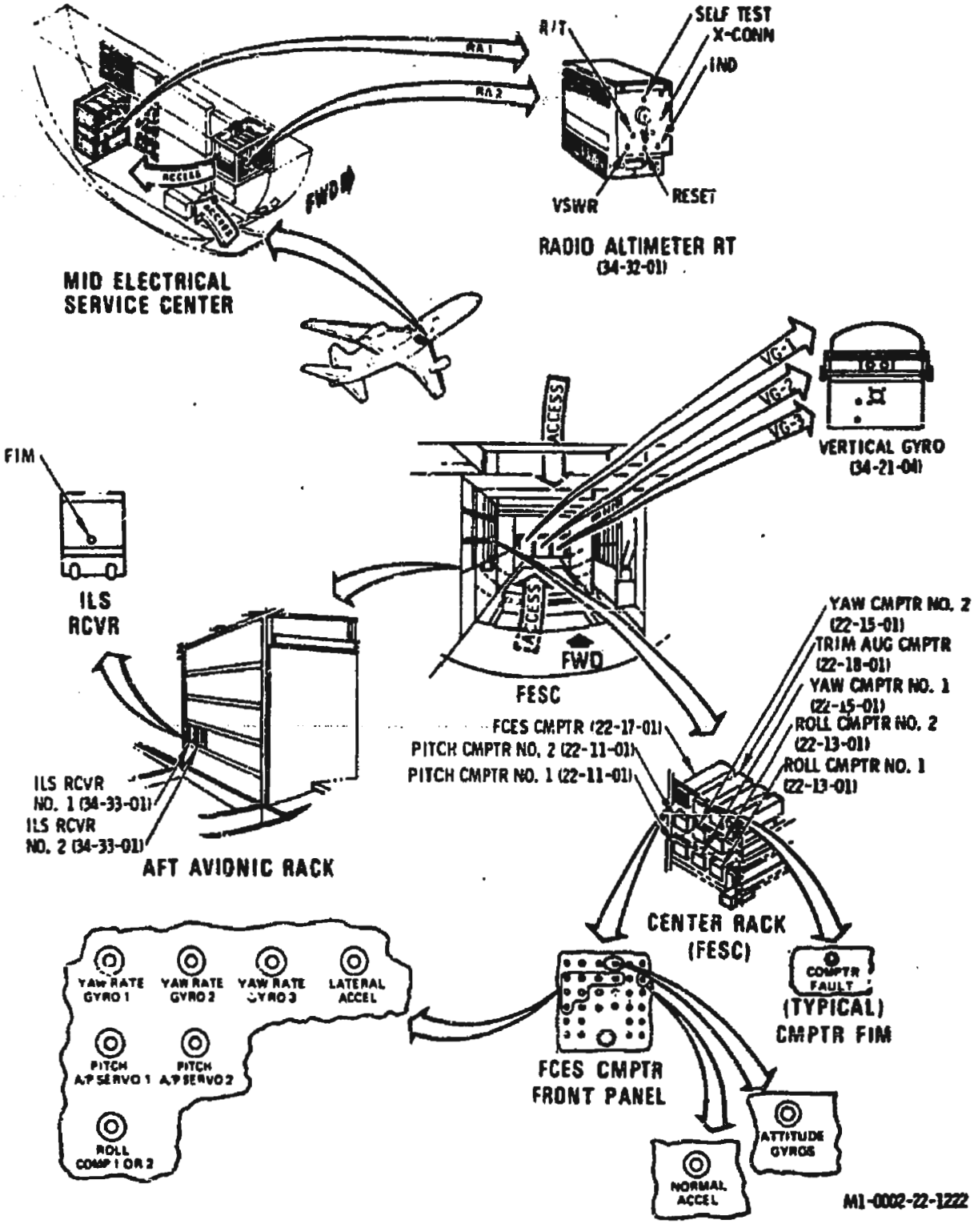
R
R

Component Locator Diagram
Figure 102 (Sheet 1)

EFFECTIVITY: ALL

001B

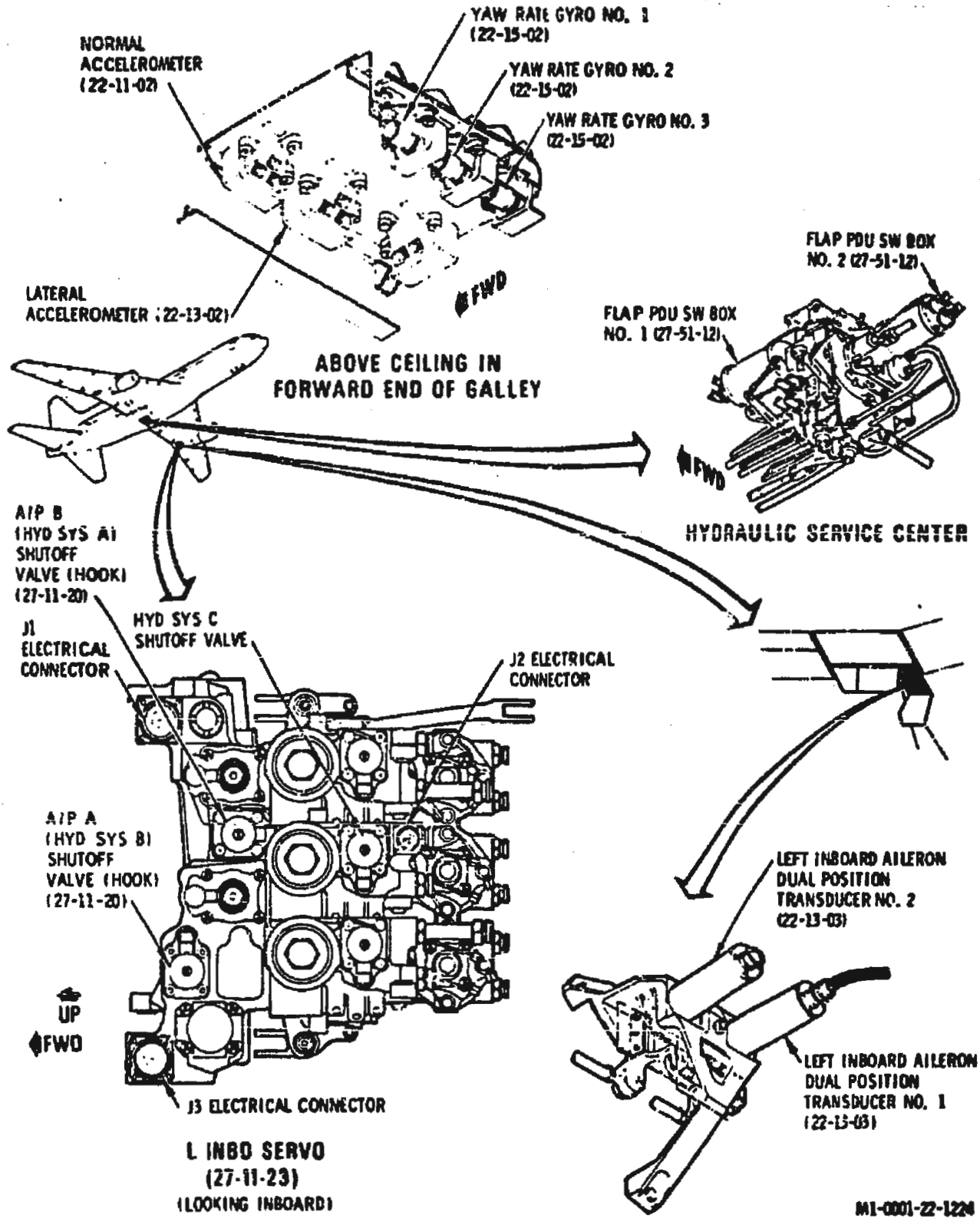


R
R

Component Locator Diagram
Figure 102 (Sheet 2)

EFFECTIVITY: ALL

0018

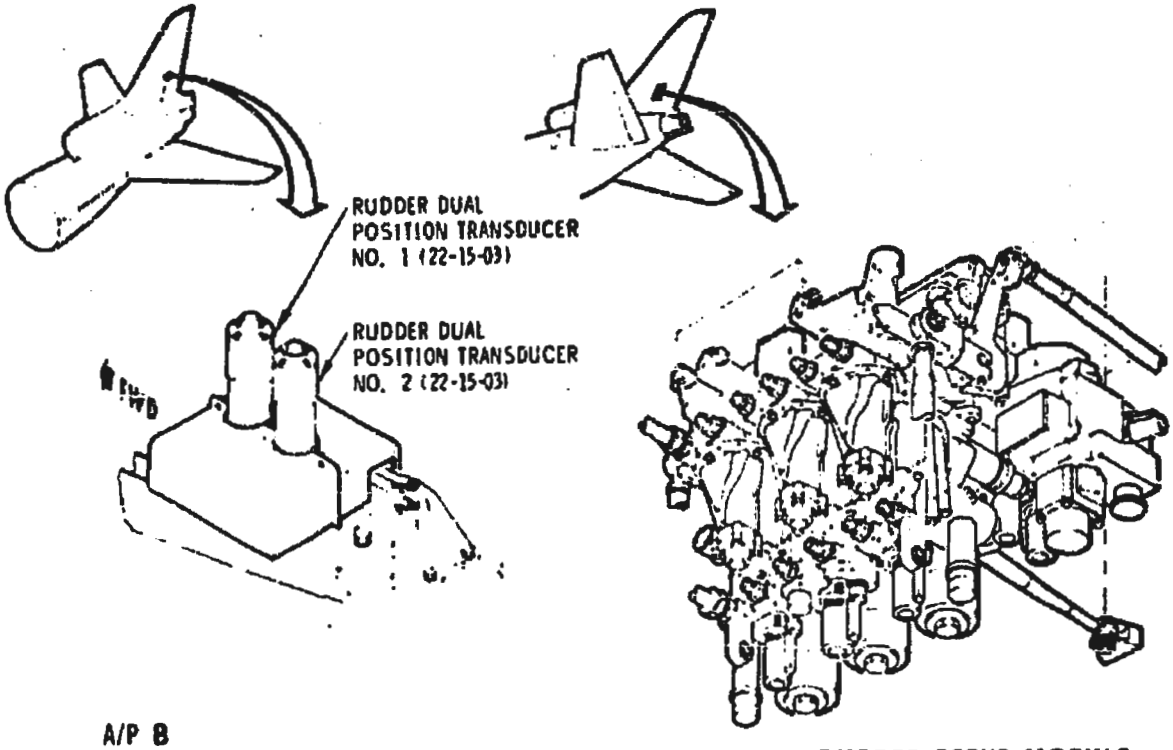

YAW RATE GYRO NO. 1 (22-15-02)
NORMAL ACCELEROMETER (22-11-02)
YAW RATE GYRO NO. 2 (22-15-02)
YAW RATE GYRO NO. 3 (22-15-02)
LATERAL ACCELEROMETER (22-13-02)
FWD
ABOVE CEILING IN FORWARD END OF GALLEY
FLAP PDU SW BOX NO. 2 (27-51-12)
FLAP PDU SW BOX NO. 1 (27-51-12)
FWD
HYDRAULIC SERVICE CENTER
A/P B (HYD SYS A) SHUTOFF VALVE (HOOK) (27-11-20)
J1 ELECTRICAL CONNECTOR
HYD SYS C SHUTOFF VALVE
J2 ELECTRICAL CONNECTOR
A/P A (HYD SYS B) SHUTOFF VALVE (HOOK) (27-11-20)
UP
FWD
J3 ELECTRICAL CONNECTOR
L INBD SERVO (27-11-23)
(LOOKING INBOARD)
LEFT INBOARD AILERON DUAL POSITION TRANSDUCER NO. 2 (22-13-03)
LEFT INBOARD AILERON DUAL POSITION TRANSDUCER NO. 1 (22-13-03)
M1-0001-22-1224

R
R

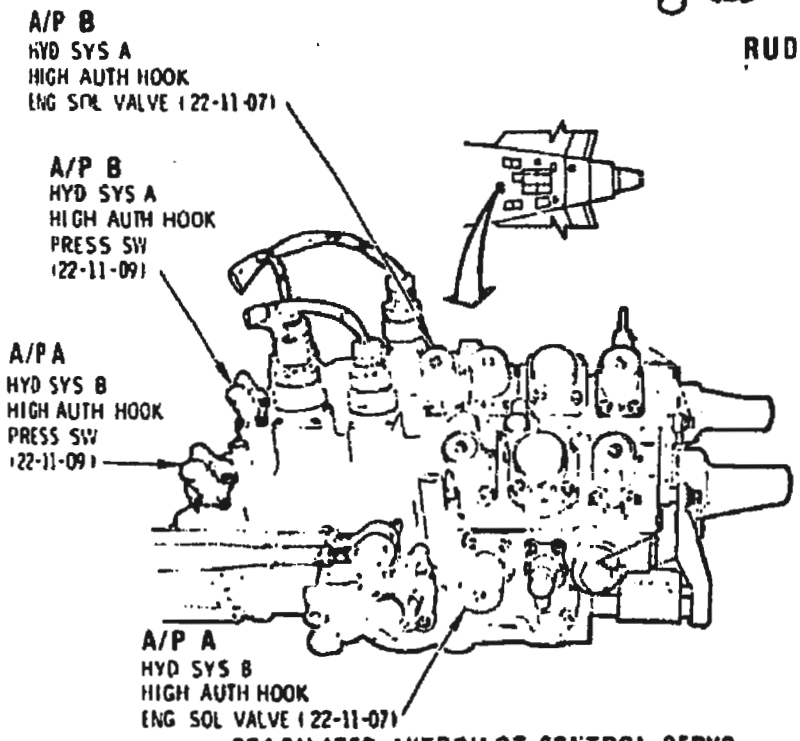
Component Locator Diagram
Figure 102 (Sheet 3)

EFFECTIVITY: ALL

0018



RUDDER SERVO MODULE
(27-21-07)



STABILIZER AUTOPILOT CONTROL SERVO
(22-11-05)

MI-0100-22-1225

R
R

Component Location Diagram
Figure 102 (Sheet 4)

EFFECTIVITY: ALL

001B

FAULTS → | ← FIM → | ← NO FIM →

No.	Problem (AP A or B)	Troubleshooting Faulty LRU: Check FIM on LRU or on front Panel of FCES Cmptr								Continuity Check or Replace						
		PC	RC	YC	YRG	RUD SERVO	ROLL SERVO	ROLL SERVO PRESS SOV	LATERAL ACCEL	AIL POSN XDCR	APFDS ENG PNL	AP PRESS SW	FLAP PDU SB	RUD POSN XDCR	ILS RCVR	RA RT
	AP A FIRM Codes With -1 ← → AP B FIRM Codes With -2															
	X ← Use With Both FIRM Codes															
	"DANA LIGHT IMMEDIATELY AFTER AP TURN ON, OR DURING STRAIGHT AND LEVEL FLIGHT FAULTS" (Ref. Fig. 104)															
1	DANA light comes on immediately after AP bat handle is set to CWS or CMD from OFF, or during straight and level flight. No other cockpit indications.	1/2	1/2	1/2	1/2/3				X							
2 ⚠1	DANA light comes on immediately after AP bat handle is set to CWS or CMD from OFF, or during straight and level flight. Capt (F/O) radio alt flag and HT flag on ADI (same side) in-view.														1/2	
3 ⚠2	DANA light comes on immediately after AP bat handle is set to CWS or CMD from OFF, or during straight and level flight with VOR freq selected When ILS freq are selected; ILS flags appear on Capt (F/O) HSI and ADI (same side), and DANA can be turned off by cycling AP bat handle.														1/2	
4	DANA light comes on immediately after AP bat handle was first set to CWS or CMD from OFF. Upon cycling both YAW SAS switches to OFF, then on and AP bat handle to OFF, then CWS or CMD; DANA light went out and remained out for the remainer of the flight.			1/2									X			

NOTE

⚠1 DANA light does not come on when pitch cmptr modified by Collins SB 37 are used.

⚠2 DANA light does not come on when roll cmptr modified by Collins SB 38 are used.

M1-0003-22-1226

R DANA Light Fault Matrix
R Figure 103 (Sheet 1)

EFFECTIVITY: ALL

001B

FAULTS → FIM → NO FIM

No.	Problem (AP A or B)	Troubleshooting Faulty LRU: Check FIM ON LRU or on Front Panel of FCES Cmptr: PC	RC	YC	YRG	RUD SERVO	ROLL SERVO	ROLL SERVO PRESS SOV	LATERAL ACCEL	Continuity Check or Replace: AIL POSN XDCR	APFDS ENG PNL	AP PRESS SW	FLAP PDU SB	RUD POSN XDCR	ILS RCVR	RA RT
	AP A FIRM Codes With -1 / AP B FIRM Codes With -2 / X Use With FIRM Codes															
"DANA LIGHT IMMEDIATELY AFTER AP TURN ON, OR DURING STRAIGHT AND LEVEL FLIGHT (CONT)" (Ref. Fig. 104)																
5	DANA light comes on immediately after AP A (B) bat handle is set to CWS or CMD from OFF, or during straight and level flight. No DANA when other AP bat handle is set to CWS or CMD from OFF. (2)	1/2					X	B/A			X					
6	DANA light comes on immediately after AP A (B) bat handle is set to CWS or CMD from OFF, or during straight and level flight. Other AP locked-off (can't be engaged, when first AP engaged is turned off). No other cockpit indications.	1/2	1/2	1/2												
7 (1)	DANA light comes on immediately after AP A (B) bat handle is set to CWS or CMD from OFF, or during straight and level flight. Other AP is locked-off. YAW SAS FAIL light (same side) comes on during turn coordination.			1/2	1/2	X				1/2				1/2		
8 (1)	DANA light comes on immediately after AP A (B) bat handle is set to CWS or CMD from OFF, or during straight and level flight. Other AP is locked-off. YAW SAS FAIL light (same side) on "HARD FAIL."	1/2		1/2		X				1/2	B/A	X		1/2		

NOTE

(1) Replace yaw cmptr-1 (-2) after faulted (shorted) LRU is replaced. Replacing a yaw cmptr before checking for short ckt may result in burning out a fusistor in the new cmptr.

(2) This malfunction will be in the system that does not produce the DANA light when engaged.

M1-0004-22-1227

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DANA Light Fault Matrix
Figure 103 (Sheet 2)

EFFECTIVITY: ALL

0018

FAULTS — FIM — NO FIM

No.	Problem (AP A or B)	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr									Continuity Check or Replace					
		PC	RC	YC	FCES CMPTR	TAC	VG/ISU/INU	LA	NA	YRG	HI AUTH HOOK PRESS SW	HI AUTH HOOK ENG SOV	ALL POSN XDCR	FLAP PDU SB	ILS RCVR	RA RT
	AP A FIRM Codes With -1 — AP B FIRM Codes With -2															
	X — Use With Both FIRM Codes															
	"DANA LIGHT DURING AIRCRAFT ALTITUDE, HEADING, OR MODE CHANGE" (Ref. Fig. 106)															
11	DANA light comes on when AP A (B) bat handle is in CMD and GO ARND mode is engaged. No DANA when other AP bat handle is in CMD and GO AHND mode is engaged.	1/2									B/A	B/A				
12 ⚠1	DANA light comes on after GS message and prior to A/L message. FD flag in-view on Capt (F/O) ADI. Bat handle (same side) drops to OFF.	1/2													1/2	
13 ⚠1	DANA comes on after GS message and prior to A/L message. FD flag in-view on Capt (F/O) ADI. Bat handle (same side) drops to OFF. GS flags in-view on ADI and HSI (same side).														1/2	
14	DANA light comes on during turn coordination. DANA can be turned off by cycling YAW SAS sw lt to OFF, then on; and AP bat handle to OFF, then CWS or CMD during straight and level flight.			1/2						1/2/3			X	X		
15	DANA light comes on when pilot or autopilot is changing altitude, and/or direction, and/or speed. DANA can be turned off by cycling either AP bat handle to OFF, then CWS or CMD during straight and level flight.	1/2	1/2	1/2	X	X	1/2/3	X	X					X		
16	DANA light comes on at altitude greater than 1500 ft. If AP is cycled to OFF, then on below 1500 ft, DANA does not reappear. There may be a disagreement between Capt and F/O radio altitude or GS raw data.	1/2													1/2	1/2

NOTE

⚠1 DANA light does not come on when pitch cmptr modified by Collins SB 37 are used.

M1-0003-22-1220

R DANA Light Fault Matrix
R Figure 103 (Sheet 3)

EFFECTIVITY: ALL

0018

Abbreviations		Remove and Install Ref.	
		Chapt	Page
AIL POSN XDCR	Left Inboard Aileron Dual Position Transducer	22-13-03	401
APFDS ENG PNL	APFDS Engage Panel	22-10-01	401
FCES CMPTR	FCES Computer	22-17-01	401
FLAP PDU SB	Flap PDU Switch Box	27-51-12	401
HI AUTH HOOK ENG SOV	High Authority Hook Engage Shutoff Valve	22-11-07	401
HI AUTH HOOK PRESS SW	High Authority Hook Pressure Switch	22-11-09	401
ILS RCVR	ILS Receiver	34-33-01	401
IU	Inertial Unit	34-43-03	401
LA	Lateral Accelerometer	22-13-02	401
NA	Normal Accelerometer	22-11-02	401
PC	Pitch Computer	22-11-01	401
RA RT	Radio Altimeter RT	34-32-01	401
RC	Roll Computer	22-13-01	401
ROLL SERVO	L Inbd Ail Servo Cont Module	27-11-23	401
ROLL SERVO PRESS SOV	Hyd Sys B (A) Servo Press Sov	27-11-20	401
RUD SERVO	Rudder Servo Module	27-21-07	401
RUD POSN XDCR	Rudder Dual Position Transducer	22-15-03	401
TAC	Trim Augmentation Computer	22-18-01	401
VG	Vertical Gyro	34-21-04	401
YC	Yaw Computer	22-15-01	401
YRG	Yaw Rate Gyro	22-15-02	401
X	One LRU Common to Both Sys		
1 or A or C (Capt)	No. 1 LRU Associated with Sys 1 Problem		
2 or B or F (F/O)	No. 2 LRU Associated with Sys 2 Problem		
3	No. 3 LRU Common to Both Sys		

HOW TO USE

1. Find flight squawk in FAULTS column
2. Check FIM or LRU listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 and 105

M1-0003-22-1228

R
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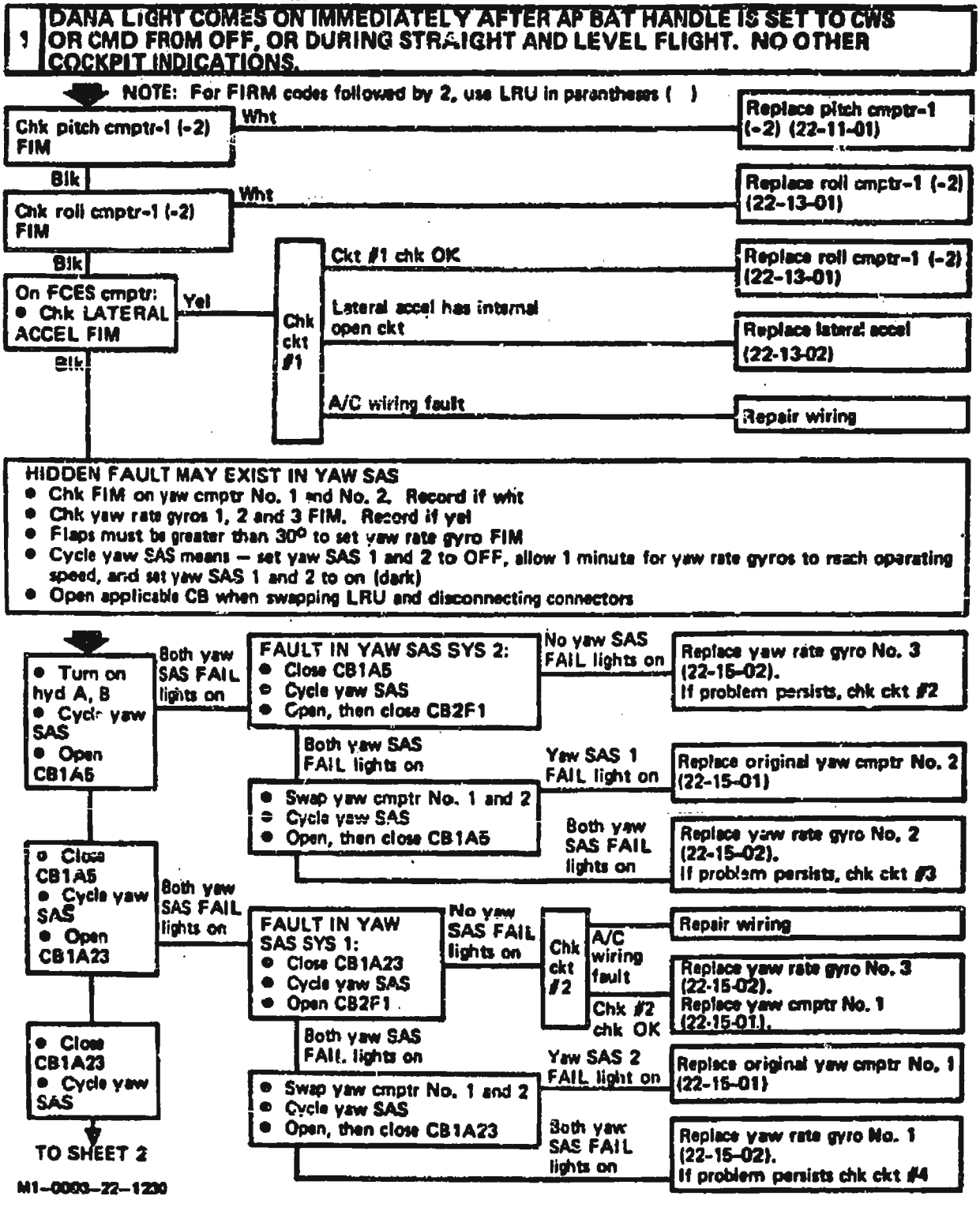
DANA Light Fault Matrix
Figure 103 (Sheet 4)

EFFECTIVITY: ALL

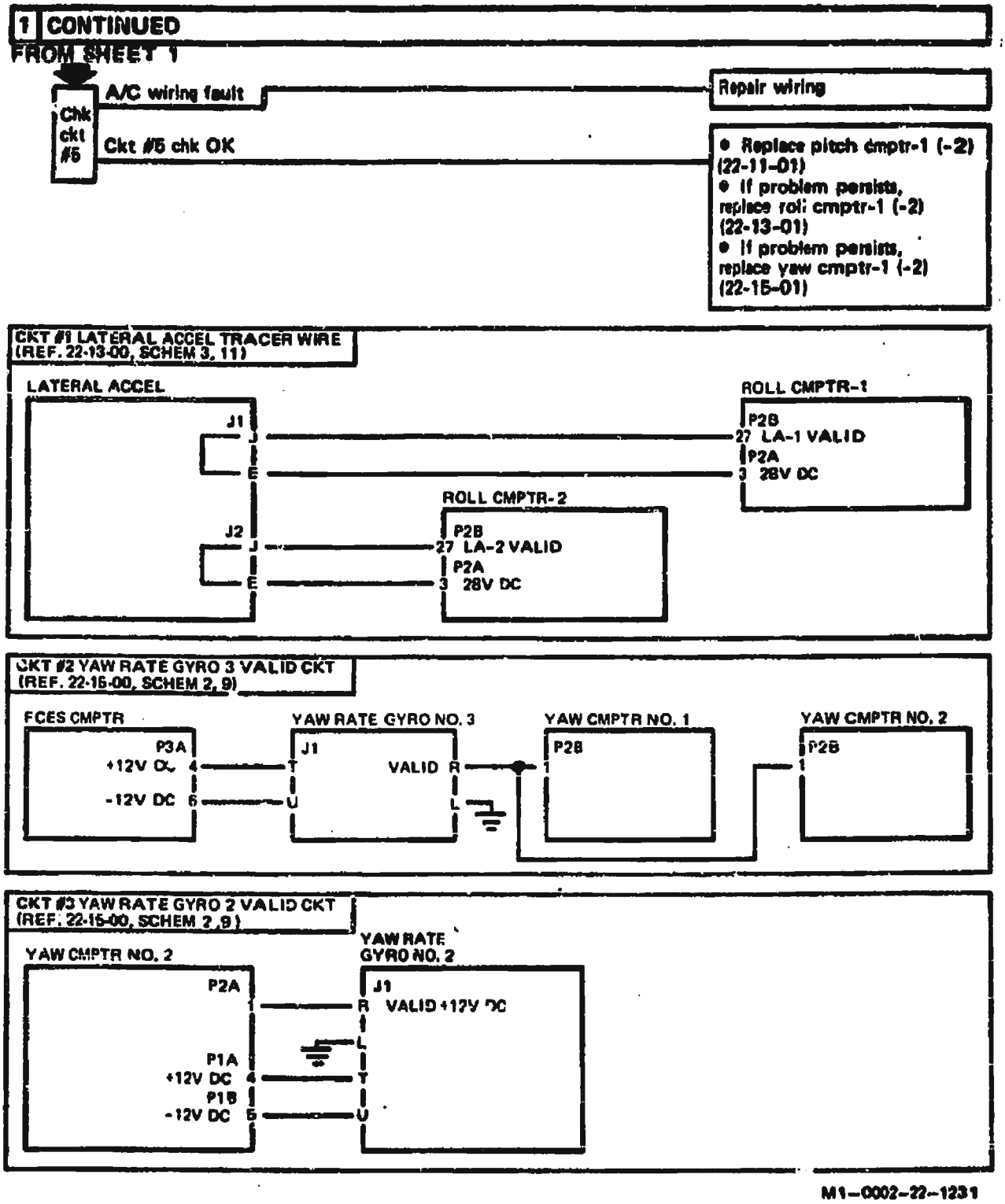
001B


1 DANA LIGHT COMES ON IMMEDIATELY AFTER AP BAT HANDLE IS SET TO CWS OR CMD FROM OFF, OR DURING STRAIGHT AND LEVEL FLIGHT. NO OTHER COCKPIT INDICATIONS.
NOTE: For FIRM codes followed by 2, use LRU in parantheses ( )
Chk pitch cmptr-1 (-2) FIM
Wht
Replace pitch cmptr-1 (-2) (22-11-01)
Blk
Chk roll cmptr-1 (-2) FIM
Wht
Replace roll cmptr-1 (-2) (22-13-01)
Blk
On FCES cmptr: • Chk LATERAL ACCEL FIM
Yel
Chk ckt #1
Ckt #1 chk OK
Replace roll cmptr-1 (-2) (22-13-01)
Lateral accel has internal open ckt
Replace lateral accel (22-13-02)
A/C wiring fault
Repair wiring
Blk
HIDDEN FAULT MAY EXIST IN YAW SAS
• Chk FIM on yaw cmptr No. 1 and No. 2. Record if wht
• Chk yaw rate gyros 1, 2 and 3 FIM. Record if yel
• Flaps must be greater than 30° to set yaw rate gyro FIM
• Cycle yaw SAS means — set yaw SAS 1 and 2 to OFF, allow 1 minute for yaw rate gyros to reach operating speed, and set yaw SAS 1 and 2 to on (dark)
• Open applicable CB when swapping LRU and disconnecting connectors
• Turn on hyd A, B
• Cycle yaw SAS
• Open CB1A5
Both yaw SAS FAIL lights on
FAULT IN YAW SAS SYS 2:
• Close CB1A5
• Cycle yaw SAS
• Open, then close CB2F1
No yaw SAS FAIL lights on
Replace yaw rate gyro No. 3 (22-15-02). If problem persists, chk ckt #2
Both yaw SAS FAIL lights on
• Swap yaw cmptr No. 1 and 2
• Cycle yaw SAS
• Open, then close CB1A5
Yaw SAS 1 FAIL light on
Replace original yaw cmptr No. 2 (22-15-01)
Both yaw SAS FAIL lights on
Replace yaw rate gyro No. 2 (22-15-02). If problem persists, chk ckt #3
• Close CB1A5
• Cycle yaw SAS
• Open CB1A23
Both yaw SAS FAIL lights on
FAULT IN YAW SAS SYS 1:
• Close CB1A23
• Cycle yaw SAS
• Open CB2F1
No yaw SAS FAIL lights on
Chk ckt #2
A/C wiring fault
Repair wiring
Replace yaw rate gyro No. 3 (22-15-02). Replace yaw cmptr No. 1 (22-15-01).
Chk #2 chk OK
• Close CB1A23
• Cycle yaw SAS
Both yaw SAS FAIL lights on
• Swap yaw cmptr No. 1 and 2
• Cycle yaw SAS
• Open, then close CB1A23
Yaw SAS 2 FAIL light on
Replace original yaw cmptr No. 1 (22-15-01)
Both yaw SAS FAIL lights on
Replace yaw rate gyro No. 1 (22-15-02). If problem persists chk ckt #4
TO SHEET 2
M1-0003-22-1230

R R Hard DANA Faults
Figure 104 (Sheet 1)

EFFECTIVITY: ALL

0018



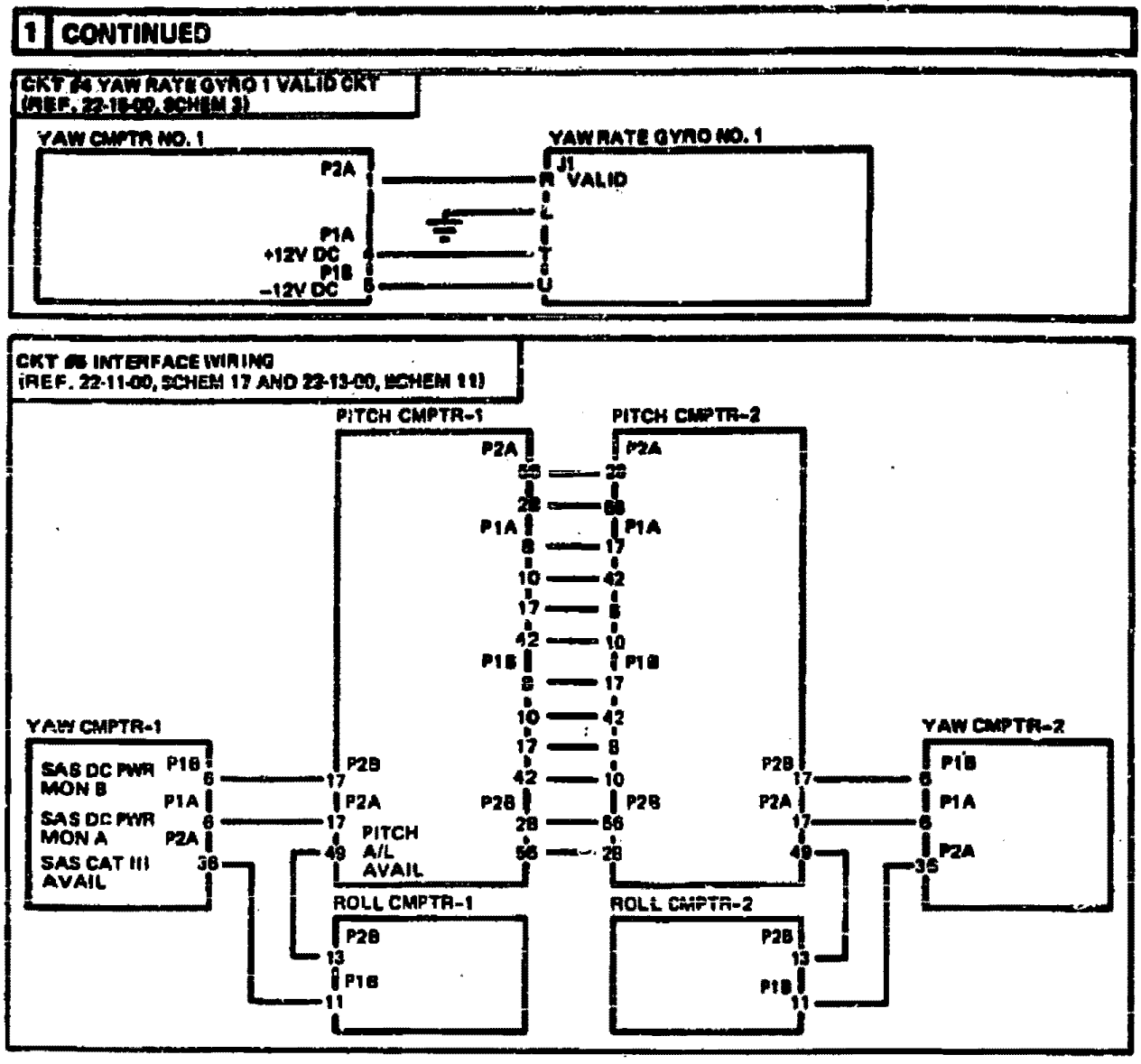
M1-0002-22-1231

R Hard DANA Faults
R Figure 104 (Sheet 2)

EFFECTIVITY: ALL

0018

1 CONTINUED

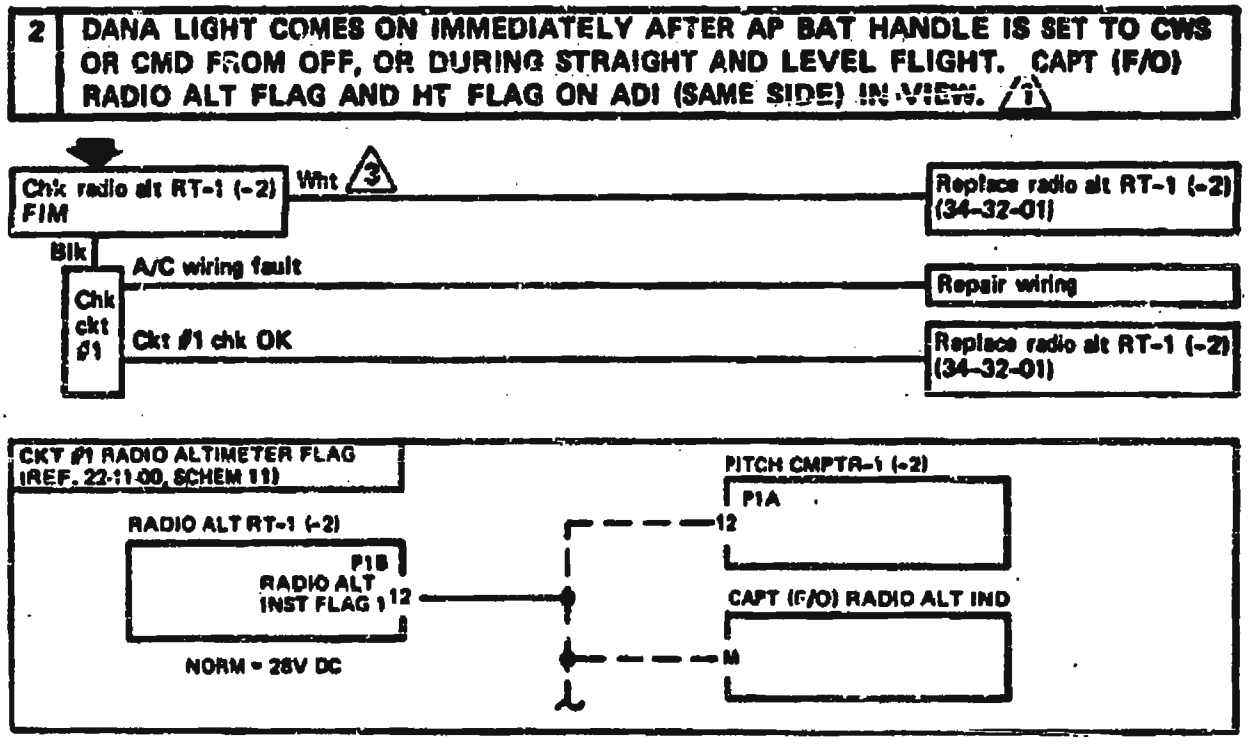


M1-0002-22-1232

R Hard DANA Faults
R Figure 104 (Sheet 3)

EFFECTIVITY: ALL

0018


2
DANA LIGHT COMES ON IMMEDIATELY AFTER AP BAT HANDLE IS SET TO CWS OR CMD FROM OFF, OR DURING STRAIGHT AND LEVEL FLIGHT. CAPT (F/O) RADIO ALT FLAG AND HT FLAG ON ADI (SAME SIDE) IN VIEW. 1
Chk radio alt RT-1 (-2) FIM
Wht 3
Replace radio alt RT-1 (-2) (34-32-01)
Blk
Chk ckt #1
A/C wiring fault
Repair wiring
Ckt #1 chk OK
Replace radio alt RT-1 (-2) (34-32-01)
CKT #1 RADIO ALTIMETER FLAG (REF. 22-11-00, SCHEM 11)
RADIO ALT RT-1 (-2)
P1B
RADIO ALT INST FLAG 1
12
NORM = 28V DC
PITCH CMPTR-1 (-2)
P1A
12
CAPT (F/O) RADIO ALT IND
M

NOTE

1 DANA light does not come on when pitch cmptr modified by Collins SB-37 are used.

2 For FIRM codes followed by -2, use LRU in parentheses ( ).

3 If FIM indication is in doubt, reset FIM (use small magnet) and test per 34-32-00, Figure 103

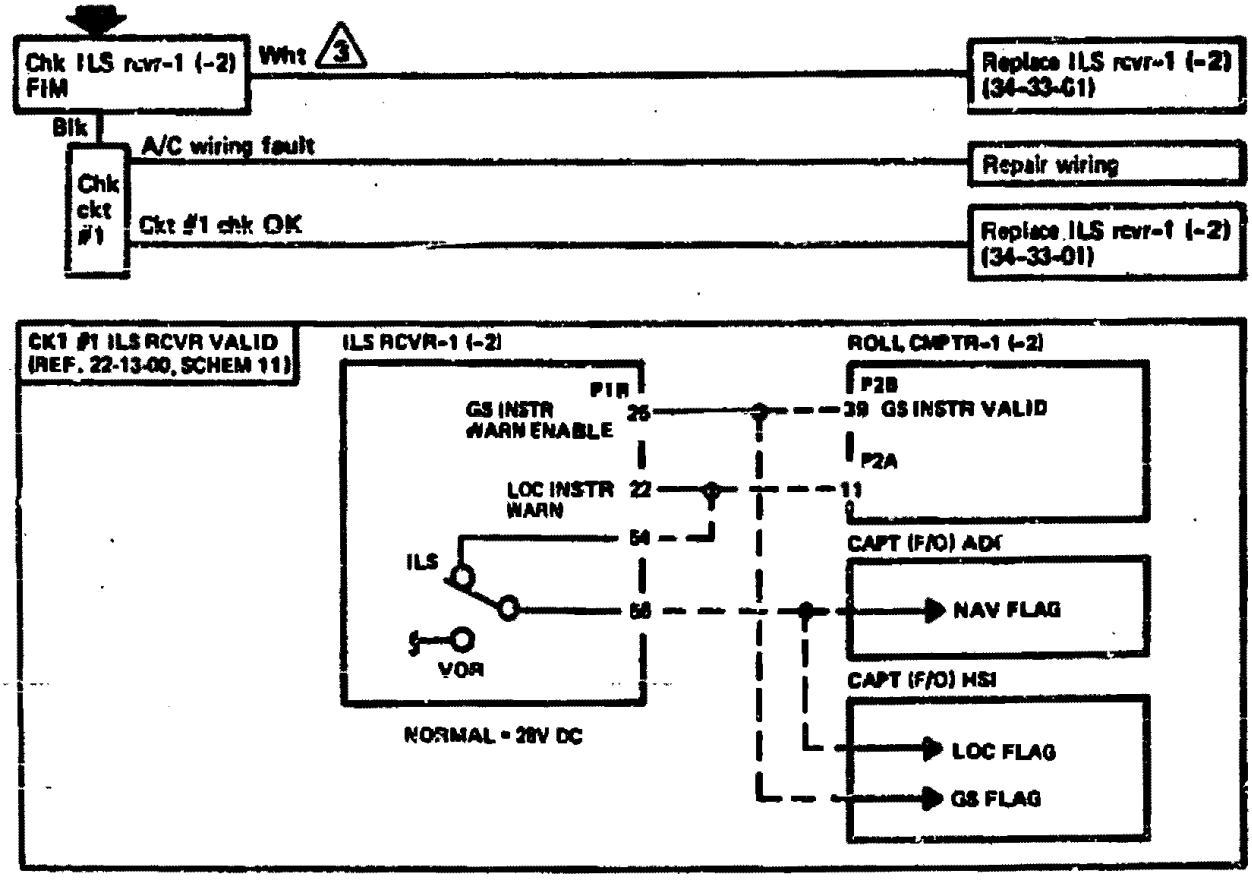
M1-0002-22-1230

R Hard DANA Faults
R Figure 104 (Sheet 4)

EFFECTIVITY: ALL

001B

3	DANA LIGHT COMES ON IMMEDIATELY AFTER AP BAT HANDLE IS SET TO CWS OR CMD FROM OFF, OR DURING STRAIGHT AND LEVEL FLIGHT WITH VOR FREQ SELECTED. WHEN ILS FREQ IS SELECTED; ILS FLAGS APPEAR ON CAPT (F/O) ADI AND HSI (SAME SIDE), AND DANA CAN BE TURNED OFF BY CYCLING AP BAT HANDLE TO OFF, THEN CWS OR CMD. (1)



NOTE

(1) DANA light does not come on when roll cmptr modified by Collins SB 38 are used.

2 For FIRM codes followed by -2, use LRU in parentheses ( ).

(3) If FIM indication is in doubt, reset FIM (use small magnet) and test per 34-33-00, Figure 107

MI-0002-22-1234

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Hard DANA Faults
Figure 104 (Sheet 5)

EFFECTIVITY: ALL

0018

4 DANA LIGHT COMES ON IMMEDIATELY AFTER AP BAT HANDLE WAS FIRST SET TO CWS OR CMD FROM OFF. UPON CYCLING BOTH YAW SAS SWITCHLIGHTS TO OFF, THEN ON, AND AP BAT HANDLE TO OFF, THEN CWS ; DANA LIGHT WENT OUT AND STAYED OUT FOR THE REMAINDER OF THE FLIGHT.

DETERMINE WHICH YAW SAS HAS HIDDEN FAULT:

- Chk FIM on yaw cmptr No. 1 and No. 2. Record if wht.
- Turn on hyd A, B
- Cycle yaw SAS
- Open CB1A5

Yaw SAS 1 FAIL light on

Turn control wheel full CW, then full CCW at each of the following flap settings:
- 0°
- >4°
- >30°

When failed, reset yaw SAS 2 light to chk other flap settings

Yaw SAS 2 FAIL light comes on

- Was yaw cmptr-2 FIM recorded at beginning

Yes → Replace yaw cmptr-2 (22-15-01)

No → Chk ckt #1 and replace Flap PDU sw box (27-51-12)

Yaw SAS 2 FAIL light not on

- Close CB1A5
- Cycle yaw SAS
- Open CB1A23

Yaw SAS 2 FAIL light comes on

Turn control wheel full CW, then full CCW at each of the following flap settings:
- 0°
- >4°
- >30°

When failed, reset yaw SAS 1 light to chk other flap settings

Yaw SAS 1 FAIL light comes on

- Was yaw cmptr -1 FIM recorded at beginning

Yes → Replace yaw cmptr-1 (22-15-01)

No → Chk ckt #2 and replace Flap PDU sw box (27-51-12)

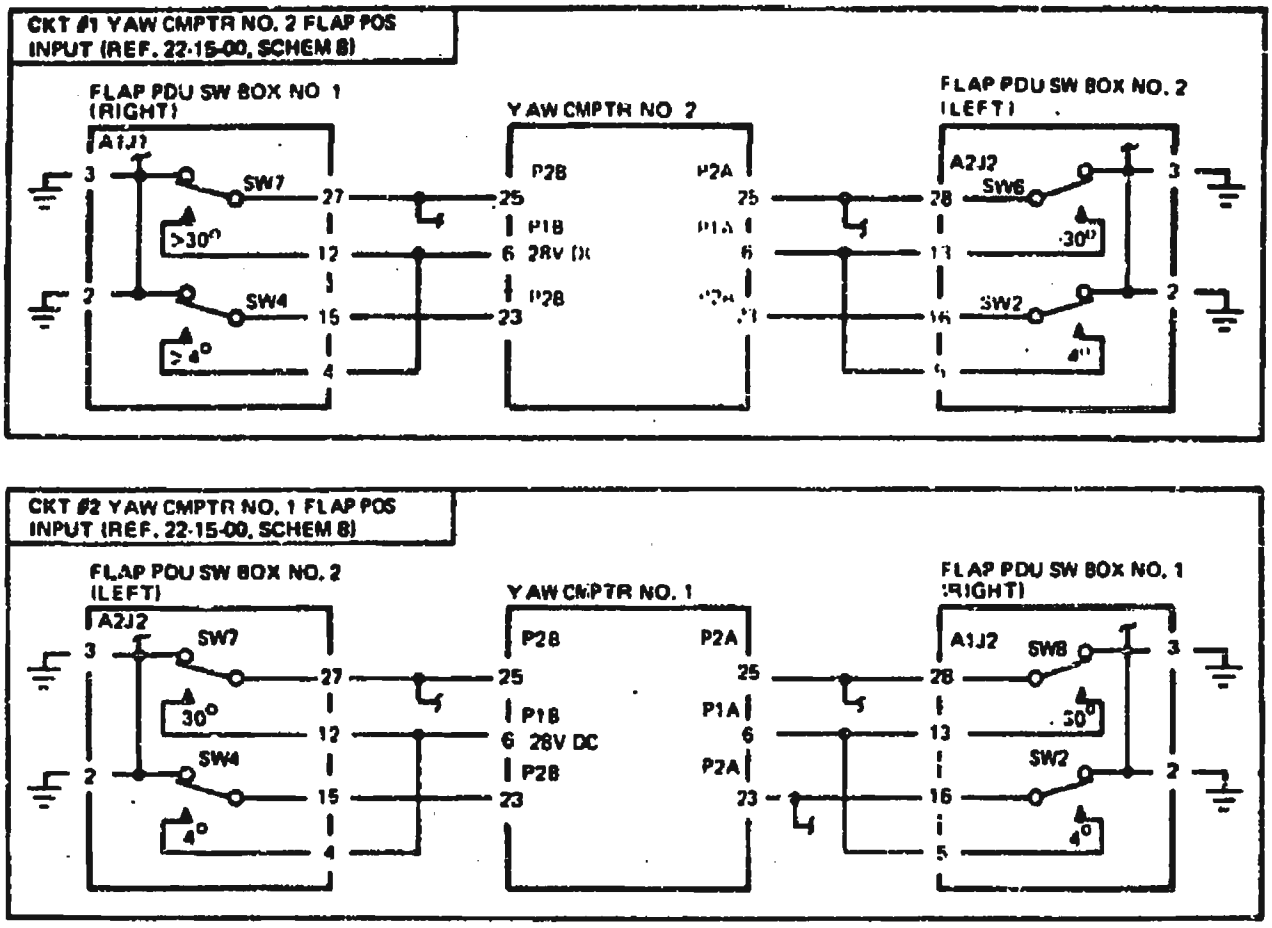
M1-0002-22-1236

R R Hard DANA Faults
Figure 104 (Sheet 6)

EFFECTIVITY: ALL

001B

4 CONTINUED



M1-0001-22-1236

Hard DANA Faults
Figure 104 (Sheet 7)

EFFECTIVITY: ALL

001B

6 DANA LIGHT COMES ON IMMEDIATELY AFTER AP A (B) BAT HANDLE IS SET TO CWS OR CMD, OR DURING STRAIGHT AND LEVEL FLIGHT. NO DANA LIGHT WHEN OTHER BAT HANDLE IS SET TO CWS OR CMD FROM OFF

Roll cmptr P2A-49 short to gnd in the system that does not produce the DANA light when engaged.

Swap roll cmptr No. 1 and No. 2

Fault moves to other system → Replace original roll cmptr-1 (-2) (22-13-01)

Fault remains

Chk ckt #1

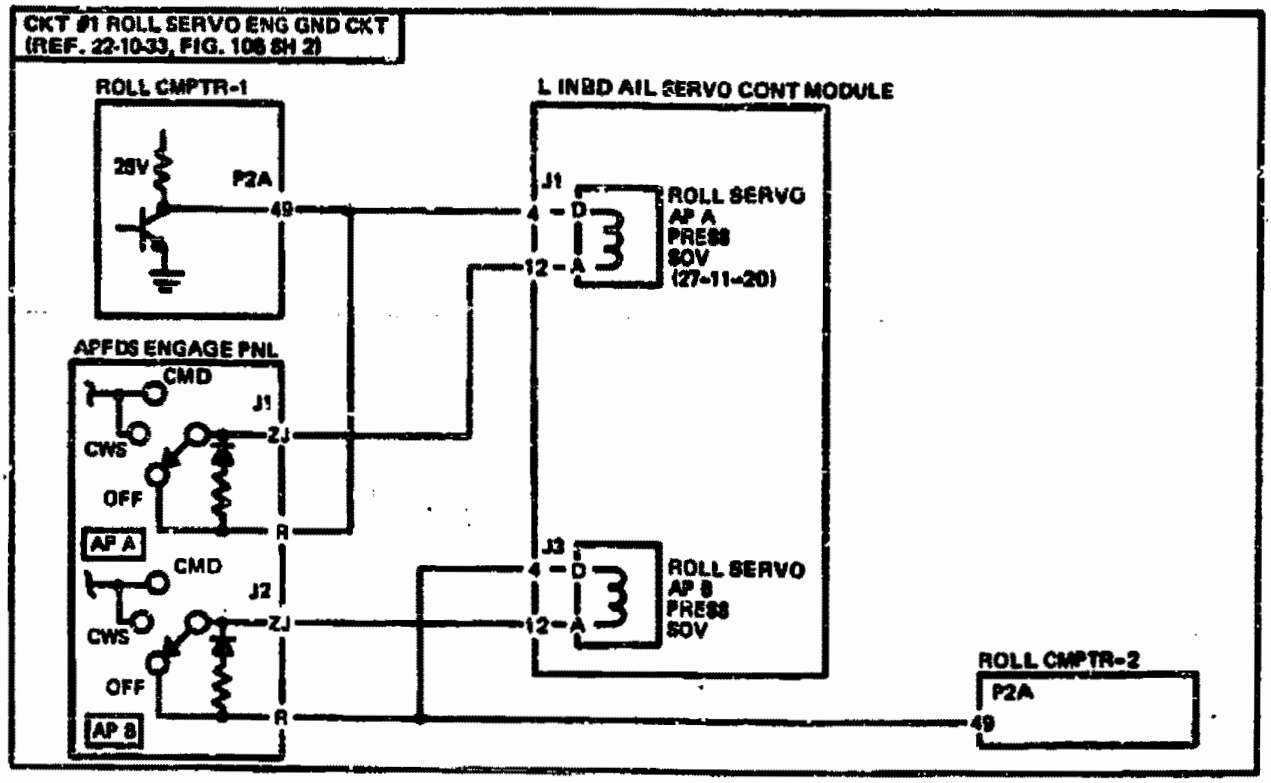
A/C wiring short to gnd → Repair wiring

Engage pnl has short to gnd → Replace APFDS engage pnl (22-10-01)

SOV has short to gnd → Replace roll servo AP A (B) press SOV (27-11-20)

NOTE

For FIRM codes followed by -2, use LRU in parentheses ( ).



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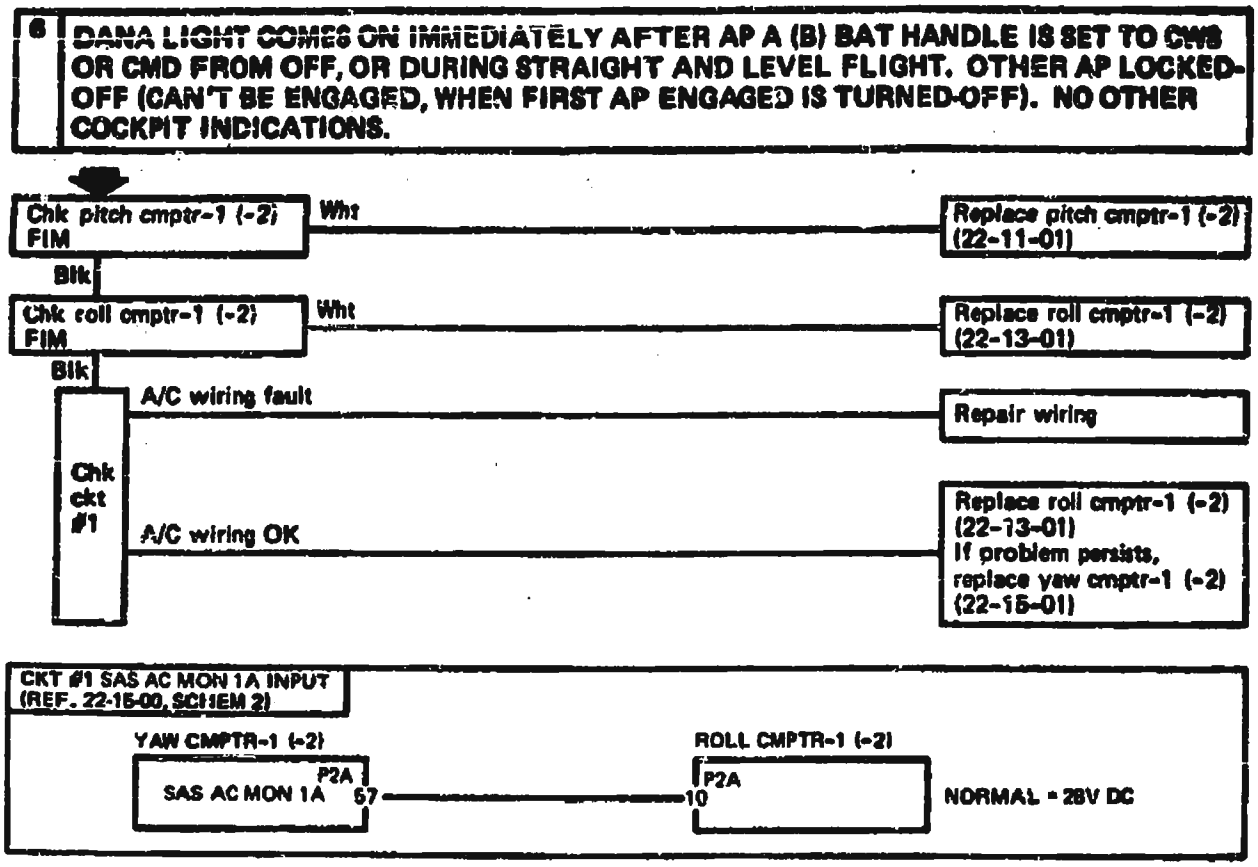
Hard DANA Faults
Figure 104 (Sheet 8)

EFFECTIVITY: ALL

001B


6
DANA LIGHT COMES ON IMMEDIATELY AFTER AP A (B) BAT HANDLE IS SET TO CWS OR CMD FROM OFF, OR DURING STRAIGHT AND LEVEL FLIGHT. OTHER AP LOCKED-OFF (CAN'T BE ENGAGED, WHEN FIRST AP ENGAGED IS TURNED-OFF). NO OTHER COCKPIT INDICATIONS.
Chk pitch cmptr-1 (-2) FIM
Wht
Replace pitch cmptr-1 (-2) (22-11-01)
Blk
Chk roll cmptr-1 (-2) FIM
Wht
Replace roll cmptr-1 (-2) (22-13-01)
Blk
Chk ckt #1
A/C wiring fault
Repair wiring
A/C wiring OK
Replace roll cmptr-1 (-2) (22-13-01)
If problem persists, replace yaw cmptr-1 (-2) (22-15-01)
CKT #1 SAS AC MON 1A INPUT (REF. 22-15-00, SCHEM 2)
YAW CMPTR-1 (-2)
SAS AC MON 1A
P2A
57
ROLL CMPTR-1 (-2)
P2A
10
NORMAL = 28V DC

7 DANA LIGHT COMES ON IMMEDIATELY AFTER AP A (B) BAT HANDLE IS SET TO CWS OR CMD FROM OFF, OR DURING STRAIGHT AND LEVEL FLIGHT. AP A (B) BAT HANDLE LOCKED-OFF. YAW SAS FAIL LIGHT (SAME SIDE) COMES ON DURING TURN COORDINATION.

FAULT YAW CMPTR 26V AC PWR CKT
- Yaw SAS servo-1 (-2) FIM w/ht
- Ensure that all applicable CB are opened before checking continuity

NOTE

1 Replace yaw cmptr-1 (-2) after faulted (shorted) LRU is replaced. Replacing a yaw cmptr before checking for short ckt may result in burning out fusister in the new cmptr

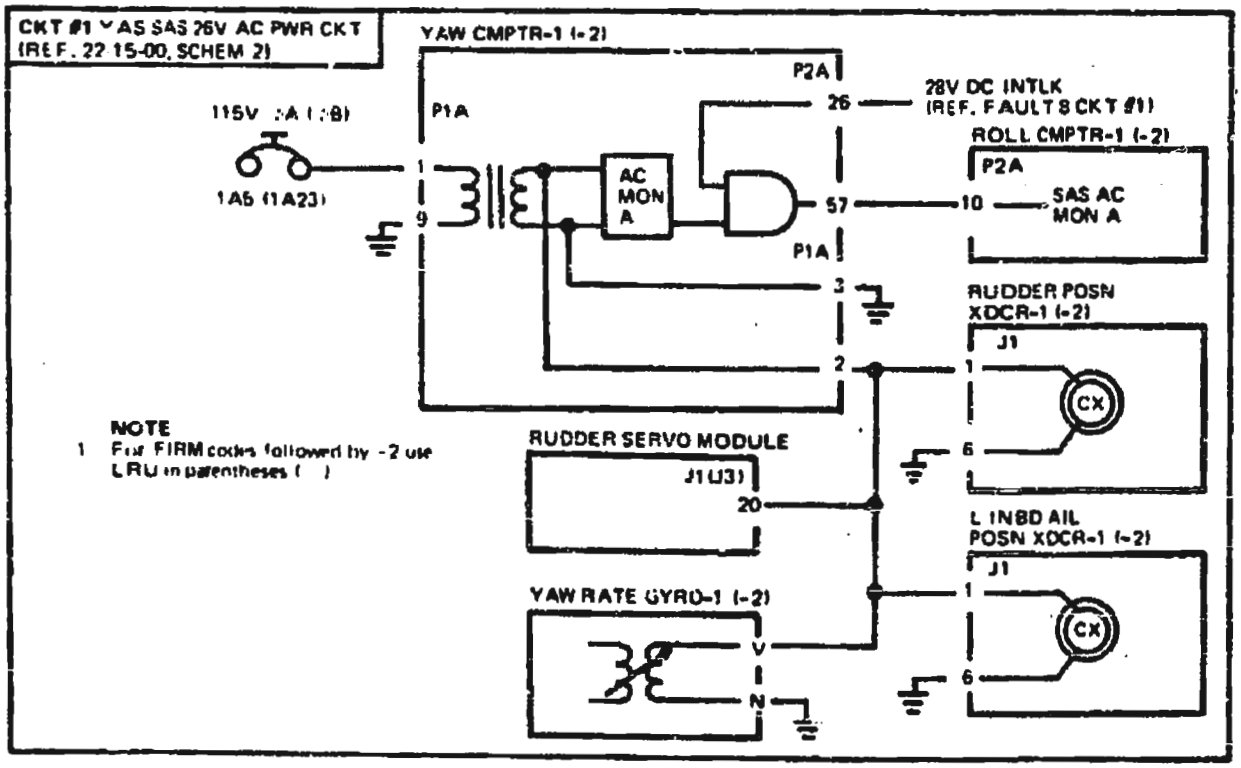
2 For FIRM codes followed by -2 use LRU in parentheses ( )

DETERMINE FAULTED LRU

- Remove yaw cmptr-1 (-2).
- Chk yaw cmptr-1 (-2) P1A-2 to gnd (Ref. ckt #1)
- Is resistance less than 100 ohm (short)?

Yes (P1A-2 short to gnd) → Replace shorted LRU (1):
- Yaw rate gyro-1 (-2) (22-15-02).
- L inbd ail posn xdcr-1 (-2) (22-13-03).
- Rudder dual posn xdcr-1 (-2) (22-15-03).
- Rudder servo module (27-21-07)

No → Replace yaw cmptr-1 (-2) (22-15-01)



M1-0002-22-1238

R R Hard DANA Faults
Figure 104 (Sheet 10)

8 DANA LIGHT COMES ON IMMEDIATELY AFTER AP A (B) BAT HANDLE IS SET TO CWS OR CMD FROM OFF, OR DURING STRAIGHT AND LEVEL FLIGHT. AP A (B) BAT HANDLE LOCKED-OFF. YAW SAS FAIL LIGHT (SAME SIDE) ON, "HARD FAIL."

FAULTY YAW CMPTR DC POWER SUPPLY CKT

- Yaw cmptr-1 (-2) FIM wht
- Ensure that flaps are up and all applicable CB are opened before checking continuity

NOTE

1. Replace yaw cmptr-1 (-2) after faulted (shorted) LRU is replaced. Replacing a yaw cmptr before checking for short ckt may result in burning out a fuse/ster in the new cmptr

2 For FIRM codes followed by -2 use LRU in parentheses ( )

DETERMINE FAULTED LRU

- Remove yaw cmptr-1 (-2).
- Chk yaw cmptr-1 (-2) P1A 6 and P18-6 to gnd (Ref ckt #1)
- Is resistance less than 10 ohms (short)?

Yes (P1A-6 short to gnd) → Replace shorted LRU (1)
- Flap PDU sw box-1 (-2) (27-51-12)
- Pitch cmptr-1 (-2) (22-11-01)
- AP A (B) hyd sys B (A) press sw (27-21-24)
- Rudder servo module (27-21-07)

Yes (P18-6 short to gnd) → Replace shorted LRU (1)
- Flap PDU sw box-2 (-1) (27-51-12)
- Pitch cmptr-1 (-2) (22-11-01)

No → Is there continuity between yaw cmptr-1 (-2) P1A-6 and P2A 26 (Ref ckt #1)?

No (open ckt) → Replace open LRU:
- Rudder dual posn xdcr-1 (-2) (22-15-03).
- L inbd ail posn xdcr-1 (-2) (22-13-03).
- Repair wiring

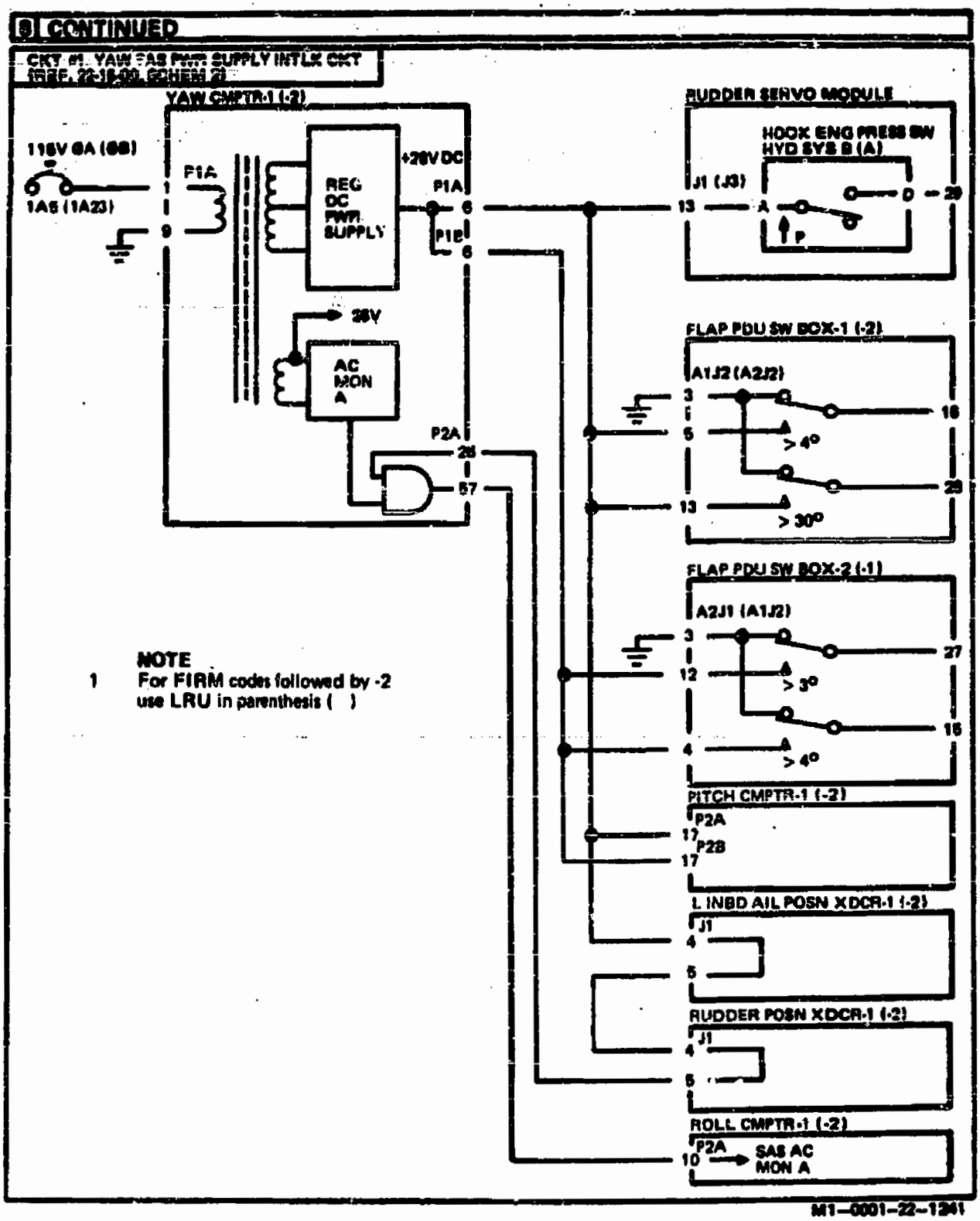
Yes → Replace yaw cmptr-1 (-2) (22-15-01)

M1-0002 22-1240

R R Hard DANA Faults
Figure 104 (Sheet 11)

EFFECTIVITY: ALL

001B



R Hard DANA Faults
R Figure 104 (Sheet 12)

11	DANA LIGHT COMES ON WHEN AP A (B) BAT HANDLE IS IN CMD AND GO AROUND MODE IS ENGAGED. NO DANA LIGHT WHEN OTHER AP BAT HANDLE IS IN CMD AND GO AROUND MODE IS ENGAGED.

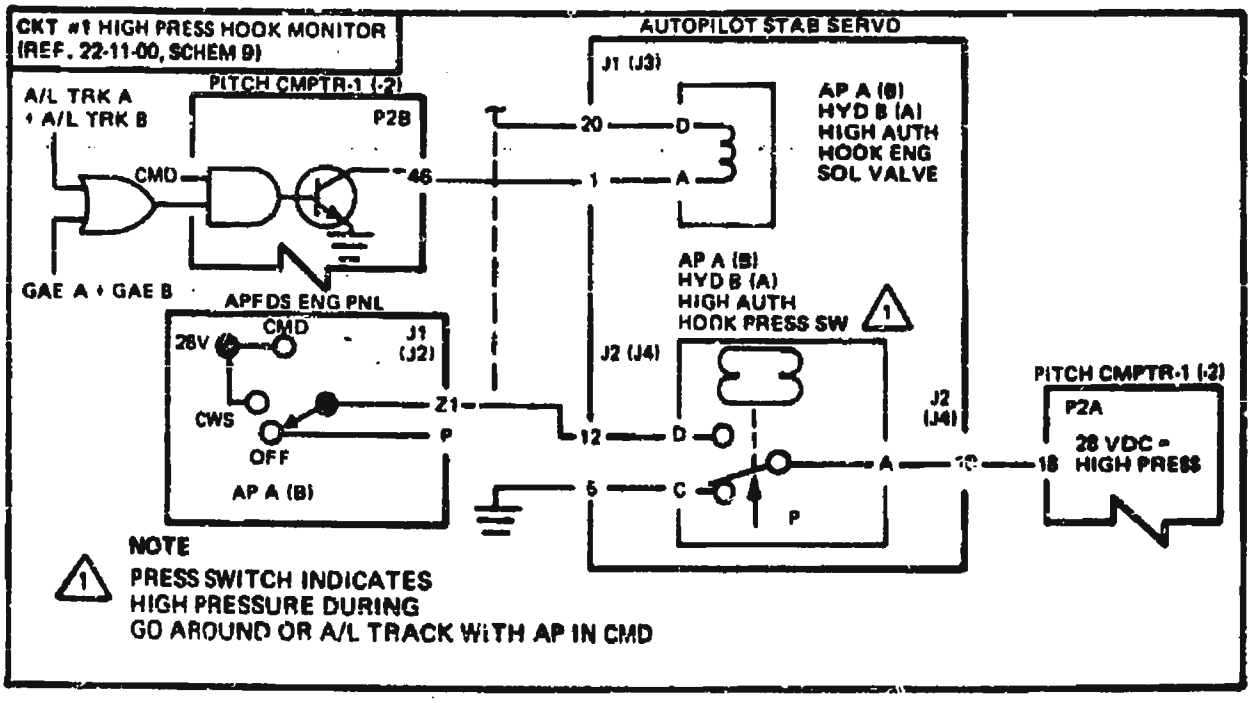
LOSS OF 28 VDC
HI PRESS HOOK MONITOR SIGNAL FROM AP SERVO

On FCES cmptr: chk pitch A/P servo 1 (2) FIM

Yes

Chk ckt # 1

- High auth hook press sw has internal open/short ckt → Replace AP A (B) hyd sys B (A) high auth hook press sw (22-11-09)
- High auth hook eng SOV has internal open/short ckt → Replace AP A (B) hyd sys B (A) high auth hook eng sol valve (22-11-07)
- Ckt # 1 chk OK → Replace pitch cmptr-1 (-2) (22-11-01)
- A/C wiring fault → Repair wiring



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R
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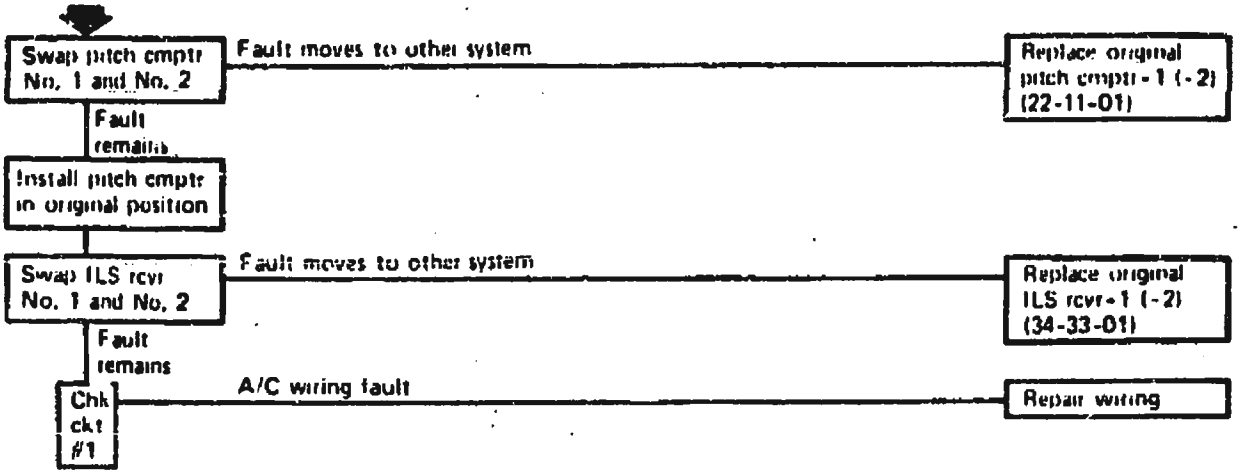
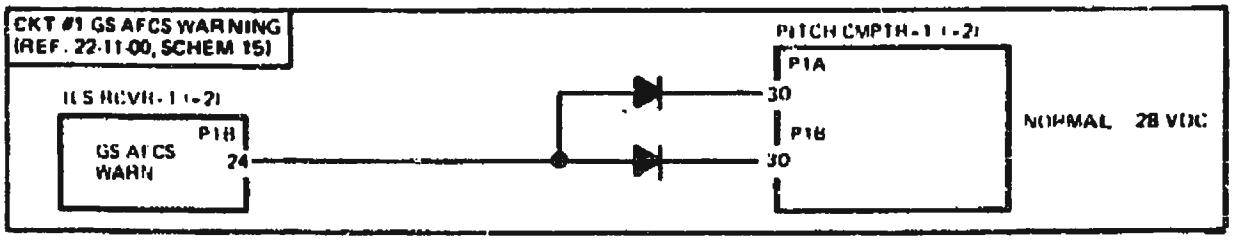
Soft DANA Faults
Figure 105 (Sheet 1)

EFFECTIVITY: ALL

001B

12 DANA LIGHT COMES ON AFTER GS MESSAGE AND PRIOR TO A/L MESSAGE. FD FLAG IN-VIEW ON CAPT (F/O) ADI. AP BAT HANDLE (SAME SIDE) DROPS TO OFF. (1)


Swap pitch cmptr No. 1 and No. 2
Fault moves to other system
Replace original pitch cmptr-1 (-2) (22-11-01)
Fault remains
Install pitch cmptr in original position
Swap ILS rcvr No. 1 and No. 2
Fault moves to other system
Replace original ILS rcvr-1 (-2) (34-33-01)
Fault remains
Chk ckt #1
A/C wiring fault
Repair wiring



13 DANA LIGHT COMES ON AFTER GS MESSAGE AND PRIOR TO A/L MESSAGE. FD FLAG IN-VIEW ON CAPT (F/O) ADI. AP BAT HANDLE (SAME SIDE) DROPS TO OFF. GS FLAGS IN-VIEW ON ADI AND HSI (SAME SIDE). (1)

NOTE

(1) DANA light does not come on when pitch cmptr modified by Collins SB 37 are used.

2 For FIRM codes followed by -2, use LRU in parenthesis ( ).

M1-0001-22-1243

R Soft DANA Faults
R Figure 105 (Sheet 2)

EFFECTIVITY: ALL

001B

14 DANA LIGHT COMES ON DURING TURN COORDINATION. DANA LIGHT CAN BE TURNED OFF BY CYCLING YAW SAS SW LIGHTS TO OFF, THEN ON, AND THEN AP BAT HANDLE TO OFF, THEN CWS OR CMD DURING STRAIGHT AND LEVEL FLIGHT.

HIDDEN FAULT EXISTS

- Chk FIM on yaw cmptr No. 1 and No. 2. Record if wht
- On FCES cmptr, chk ROLL COMP 1 or 2 FIM
- Cycle yaw SAS means – set yaw SAS 1 and 2 to OFF. Allow 1 minute for yaw rate gyros to reach operating speed, and set yaw SAS 1 and 2 to on (dark)
- Open applicable CB when swapping LRU and disconnecting connectors

DETERMINE WHICH YAW SAS HAS HIDDEN FAULT

- Turn on hyd A, B
- Cycle yaw SAS
- Open CB1A5

Yaw SAS 1 FAIL light on

"Fault in Sys 2"

Turn control wheel full CW, then full CCW at each of following flap settings:

- 0°
- 4°
- > 30°

When failed, reset yaw SAS 2 light to chk other flap settings

Yaw SAS 2 FAIL light comes on

- Was a yaw cmptr No. 2 FIM recorded at beginning or during test

No → Chk ckt #1 and replace defective Flap PDU sw box (27-51-12)

Yes → Chk ckt #2

- Aileron dual posn xdcr No. 2 has open/short ckt → Replace aileron dual posn xdcr No. 2 (22-13-03)
- Ckt #2 chk OK → Replace yaw cmptr No. 2 (22-15-01)
- A/C wiring fault → Repair wiring

Yaw SAS 2 FAIL light not on

- Close CB1A5
- Cycle yaw SAS
- Open CB1A23

Yaw SAS 2 FAIL light on

Turn control wheel full CW, then full CCW at each of following flap settings:

- 0°
- 4°
- > 30°

When failed, reset yaw SAS 1 light to check other flap settings

Yaw SAS 1 FAIL light comes on

- Was a yaw cmptr No. 1 FIM recorded at beginning?

No → Chk ckt #3 and replace defective Flap PDU sw box (27-51-12)

Yes → Chk ckt #4

- Replace aileron dual posn xdcr No. 1 (22-13-03)
- Ckt #4 chk OK → Replace yaw cmptr No. 1 (22-15-01)
- A/C wiring fault → Repair wiring

Yaw SAS 1 FAIL light not on

- Close CB1A23

To Sheet 4

M1-0001-22-1244

R R Soft DANA Faults
Figure 105 (Sheet 3)

EFFECTIVITY: ALL

0018

14 CONTINUED

FROM SHEET 3

- Was a FIM combination recorded at beginning that is shown on chart #1?

NOTE: Chart 1 shows the FIM combination that can pin point a dynamic yaw rate gyro analog fault. These fault symptoms can not be duplicated on ground.

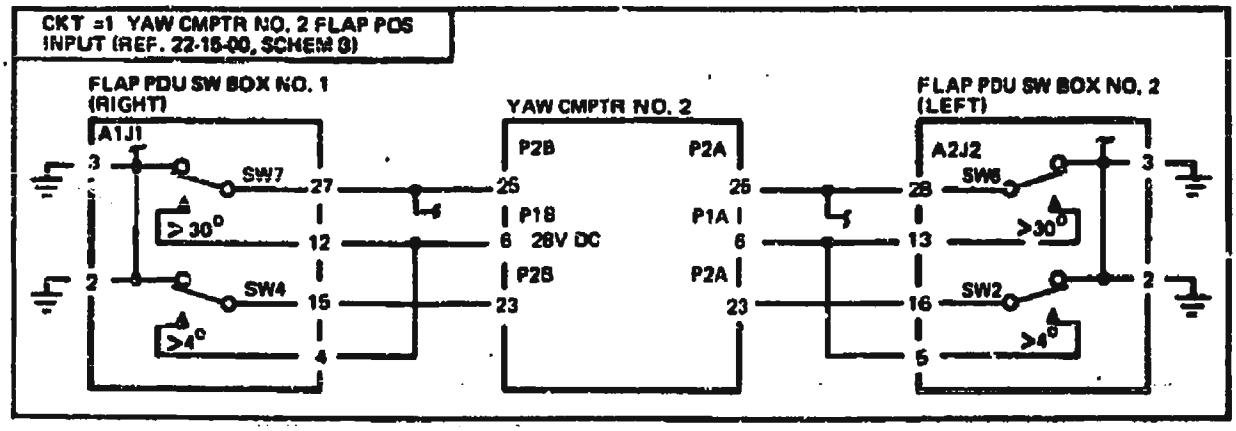
Chart #1

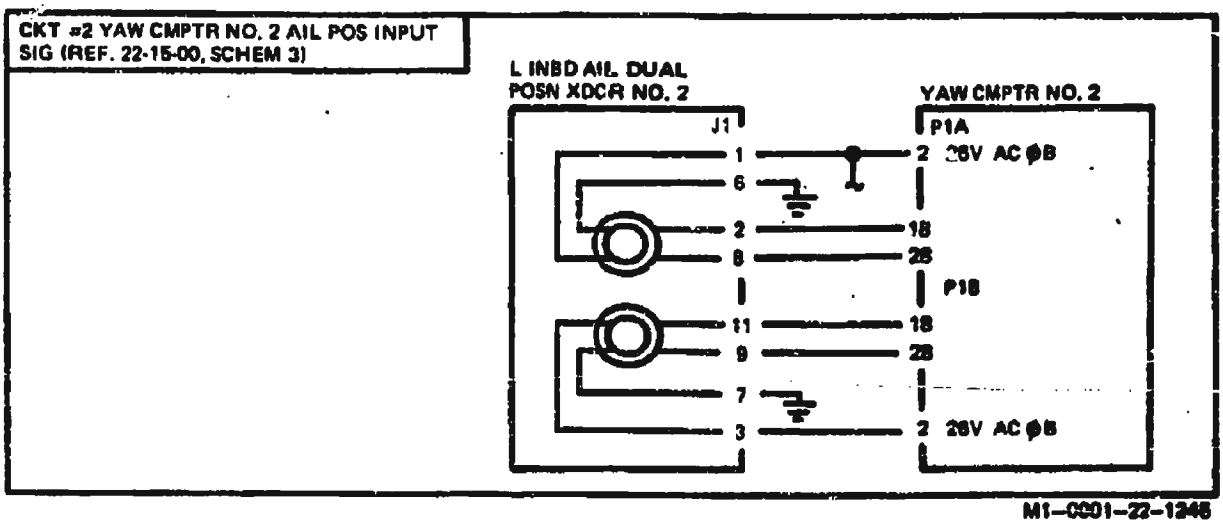
FIM			FAULTY UNIT
Yaw Cmptr-1	Yaw Cmptr-2	Roll Cmptr 1 or 2	YAW RATE GYRO ANALOG
X		X	No. 1
	X	X	No. 2
X	X		No. 3

Chk ckt #5

Ckt #5 chk OK → Replace yaw rate gyro-1 (-2) (-3) (22-15-02)

A/C wiring fault → Repair wiring





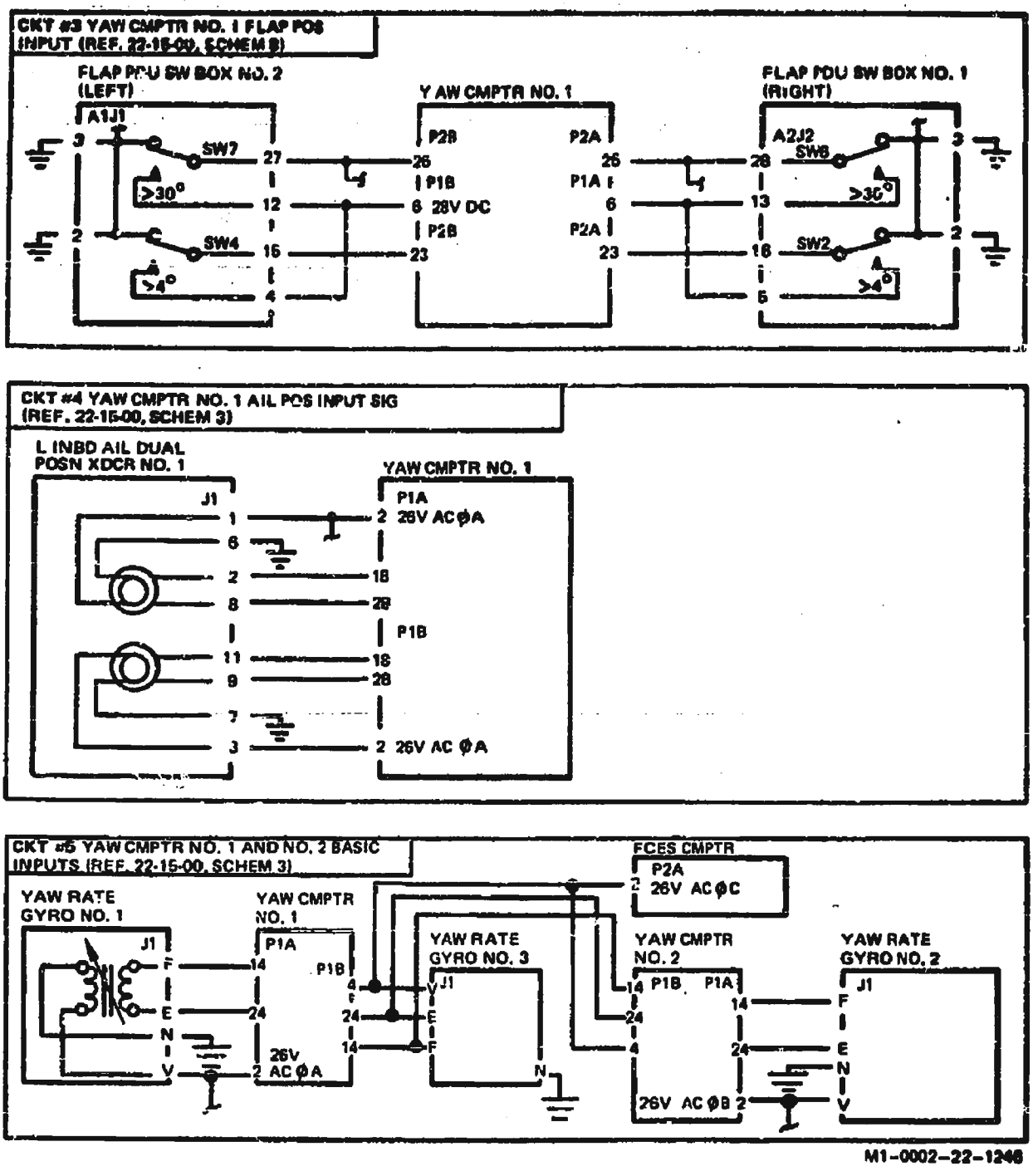
M1-0001-22-1246

R Soft DANA Faults
R Figure 105 (Sheet 4)

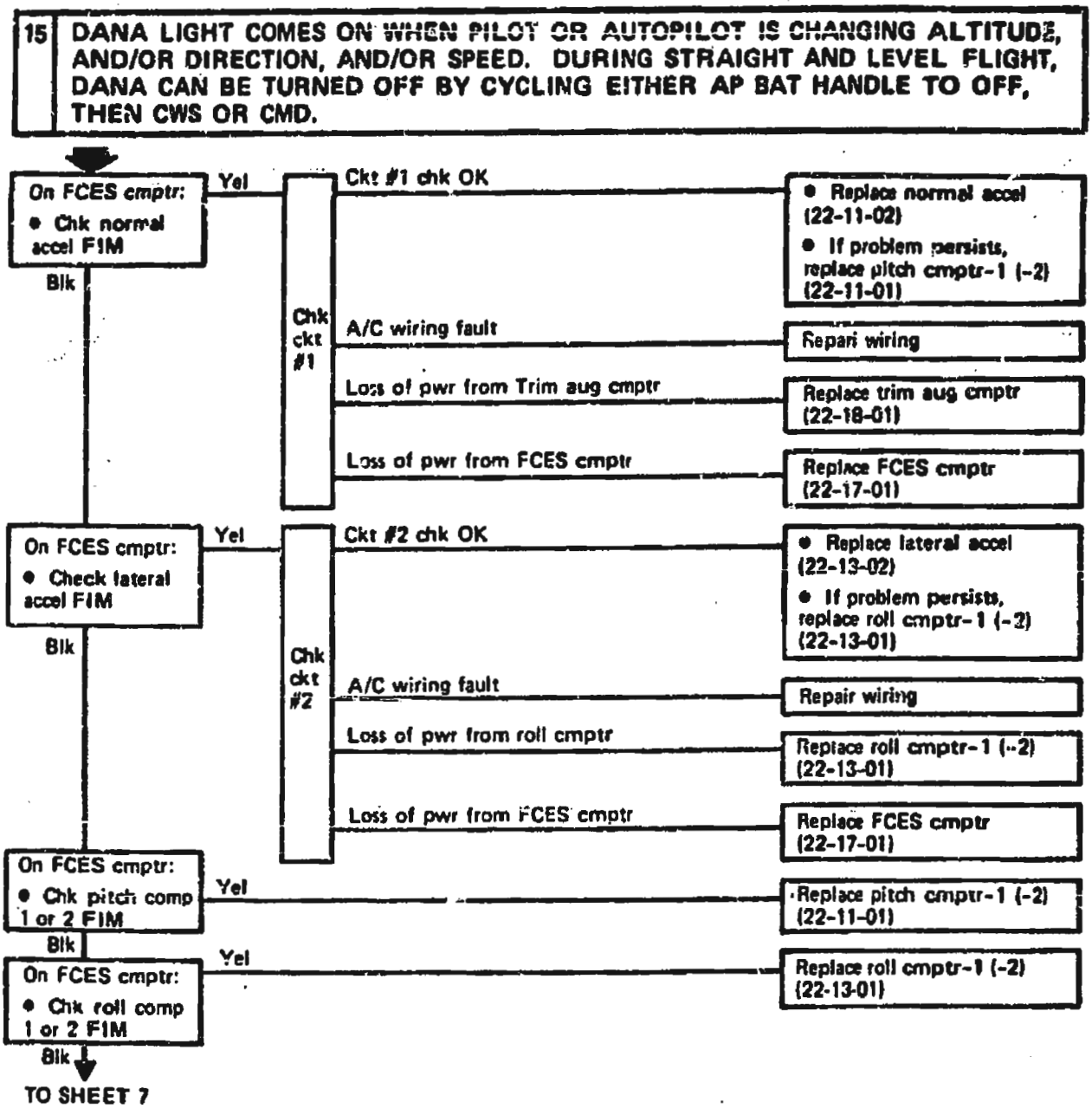
EFFECTIVITY: ALL

001B

14 CONTINUED



R Soft DANA Faults
R Figure 105 (Sheet 5)


15 DANA LIGHT COMES ON WHEN PILOT OR AUTOPILOT IS CHANGING ALTITUDE, AND/OR DIRECTION, AND/OR SPEED. DURING STRAIGHT AND LEVEL FLIGHT, DANA CAN BE TURNED OFF BY CYCLING EITHER AP BAT HANDLE TO OFF, THEN CWS OR CMD.
On FCES cmptr: • Chk normal accel FIM
Yel
Blk
Chk ckt #1
Ckt #1 chk OK
• Replace normal accel (22-11-02)
• If problem persists, replace pitch cmptr-1 (-2) (22-11-01)
A/C wiring fault
Repair wiring
Loss of pwr from Trim aug cmptr
Replace trim aug cmptr (22-18-01)
Loss of pwr from FCES cmptr
Replace FCES cmptr (22-17-01)
On FCES cmptr: • Check lateral accel FIM
Yel
Blk
Chk ckt #2
Ckt #2 chk OK
• Replace lateral accel (22-13-02)
• If problem persists, replace roll cmptr-1 (-2) (22-13-01)
A/C wiring fault
Repair wiring
Loss of pwr from roll cmptr
Replace roll cmptr-1 (-2) (22-13-01)
Loss of pwr from FCES cmptr
Replace FCES cmptr (22-17-01)
On FCES cmptr: • Chk pitch comp 1 or 2 FIM
Yel
Replace pitch cmptr-1 (-2) (22-11-01)
Blk
On FCES cmptr: • Chk roll comp 1 or 2 FIM
Yel
Replace roll cmptr-1 (-2) (22-13-01)
Blk
TO SHEET 7

M1—0100—22—1247

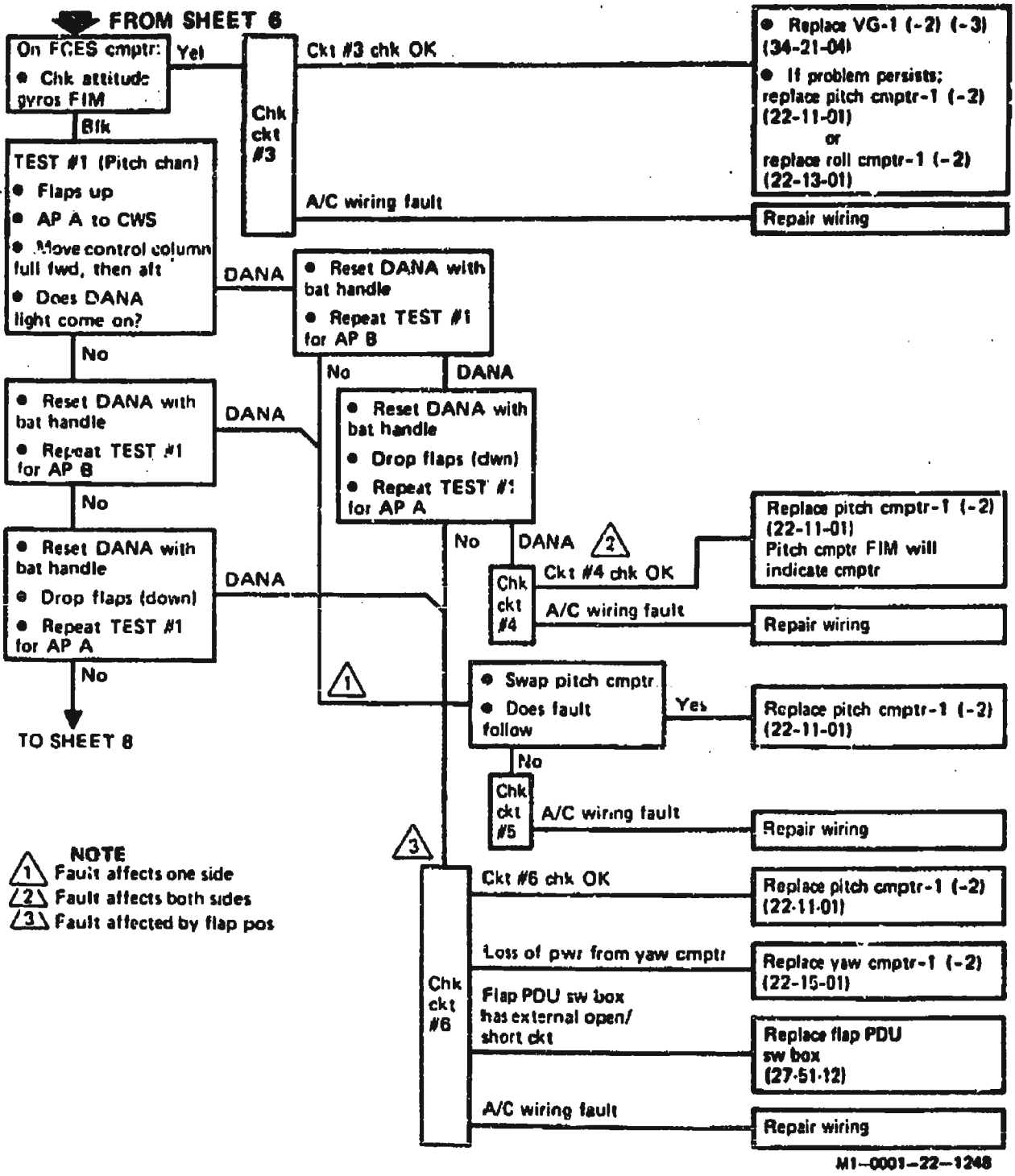
R
R

Soft DANA Faults
Figure 105 (Sheet 6)

EFFECTIVITY: ALL

001B

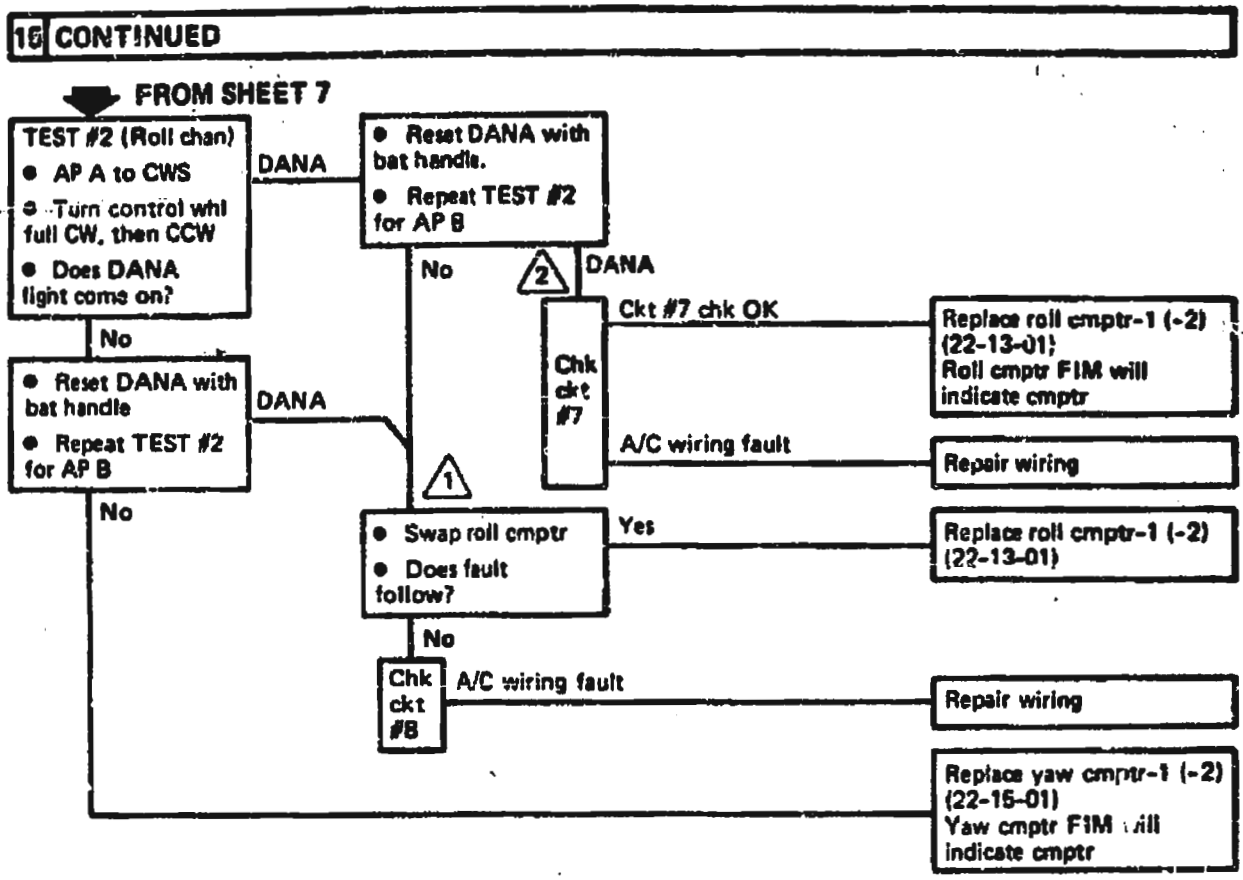
15 CONTINUED



R R Soft DANA Faults
Figure 105 (Sheet 7)

EFFECTIVITY: ALL

001B



NOTE

1 Fault affects one side

2 Fault affects both sides

M1—0100—22—1249

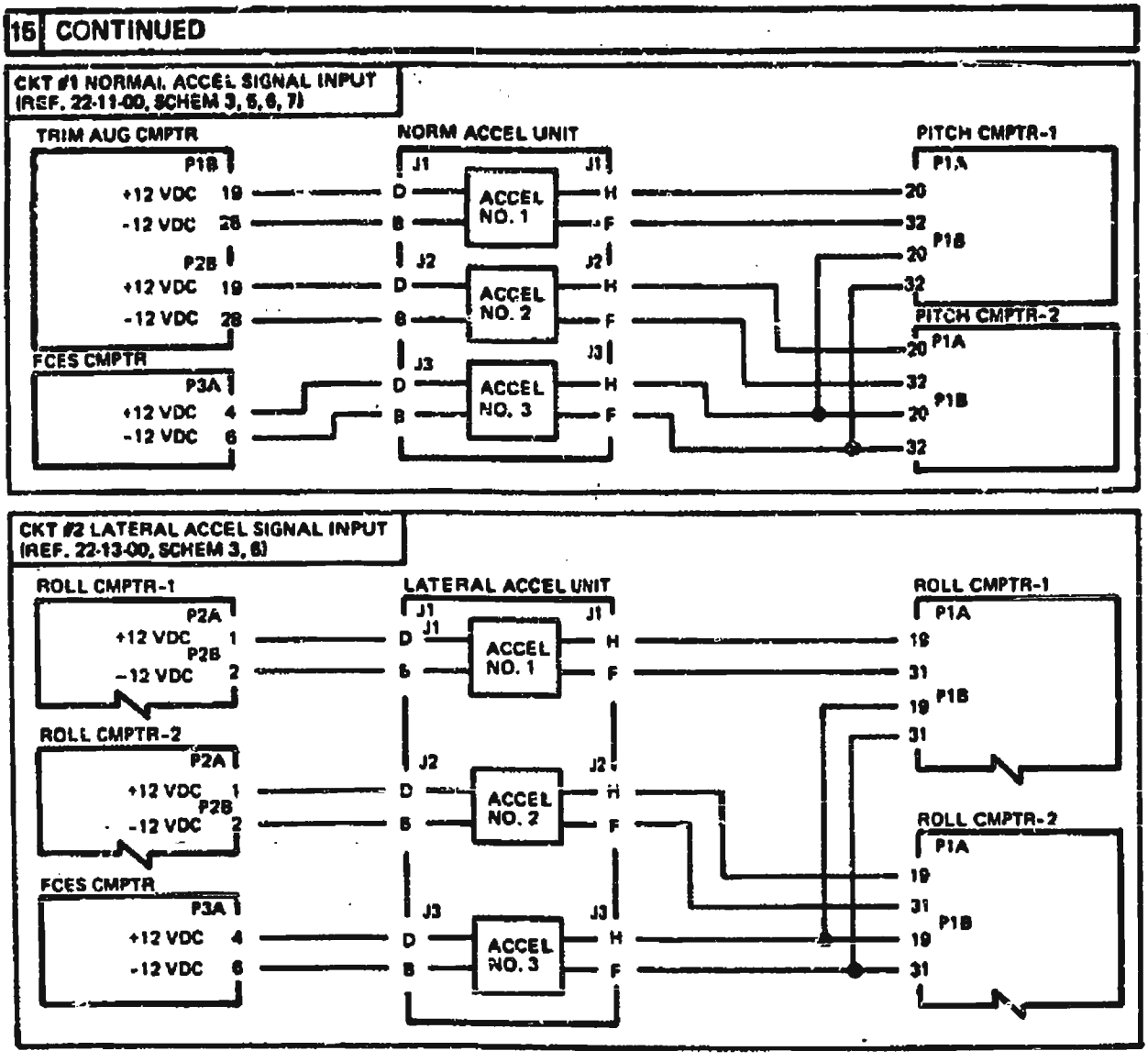
R
R

Soft DANA Faults
Figure 105 (Sheet 8)

EFFECTIVITY: ALL

001B

15 CONTINUED



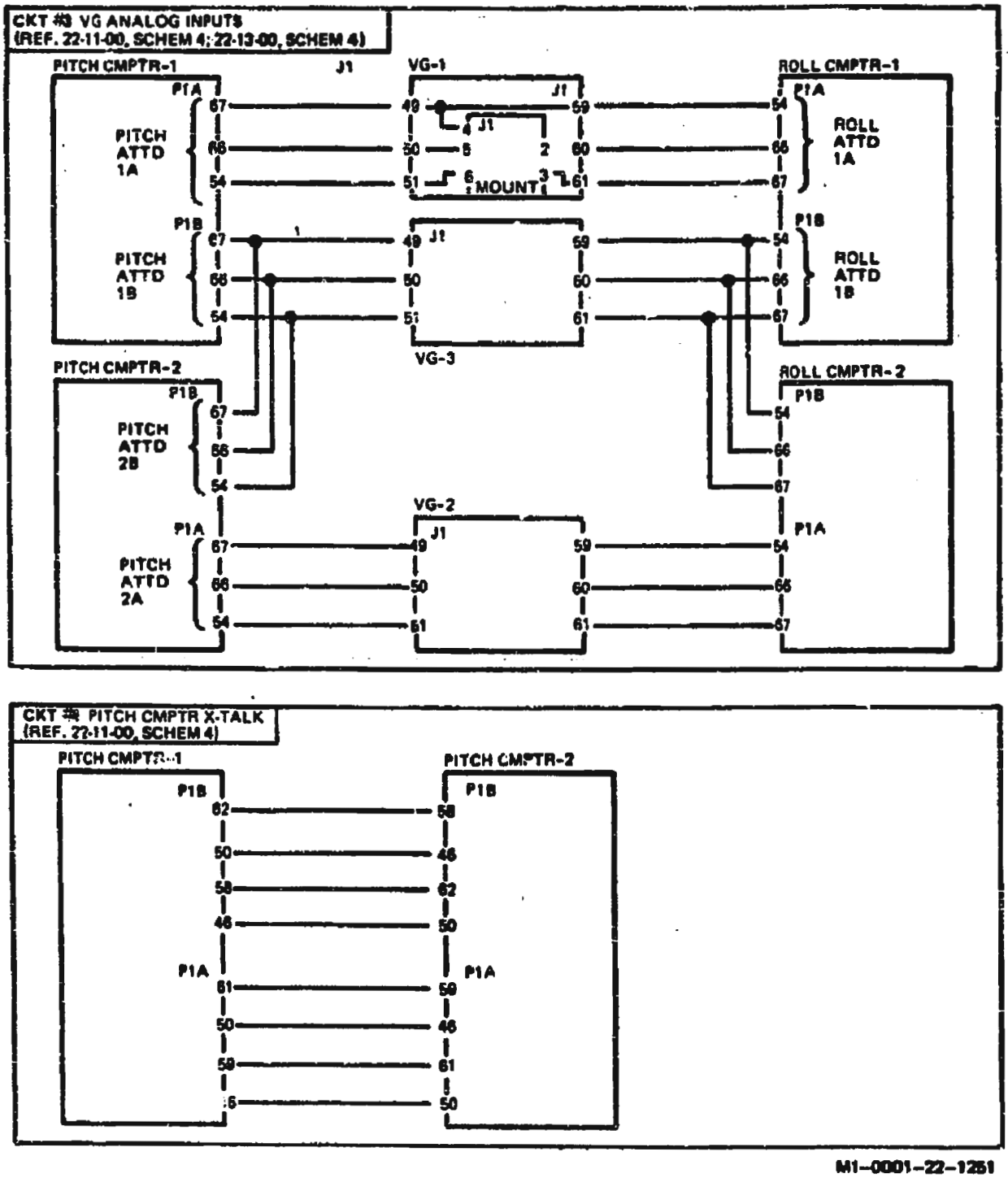
M1-0001-22-1250

R Soft DANA Faults
R Figure 105 (Sheet 9)

EFFECTIVITY: ALL

001B

15 CONTINUED



M1-0001-22-1251

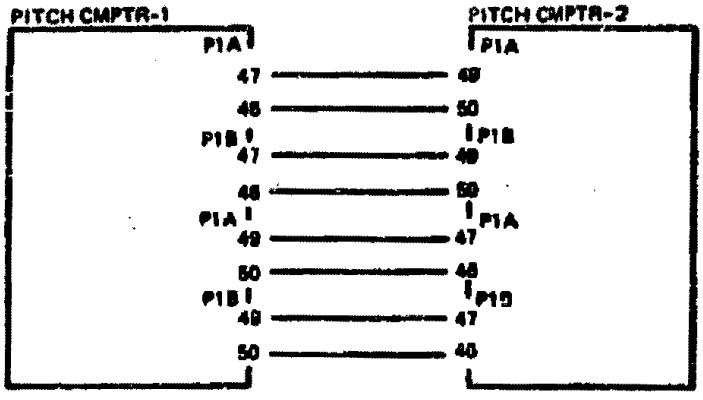
R Soft DANA Faults
R Figure 105 (Sheet 10)

EFFECTIVITY: ALL

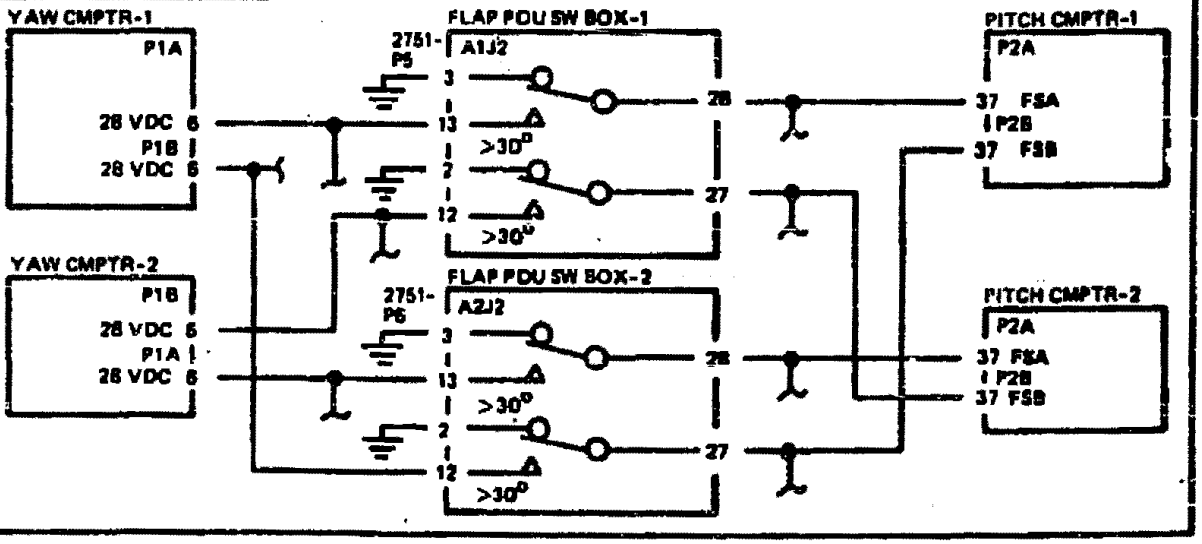
001B

16 CONTINUED

CKT #6 PITCH CMPTR X-TALK
(REF. 22-11-00, SCHEM 4)



CKT #6 FLAP POSN
(REF. 22-11-00, SCHEM 12)



M1-0001-22-1264

R
R

Soft DANA Faults
Figure 105 (Sheet 11)

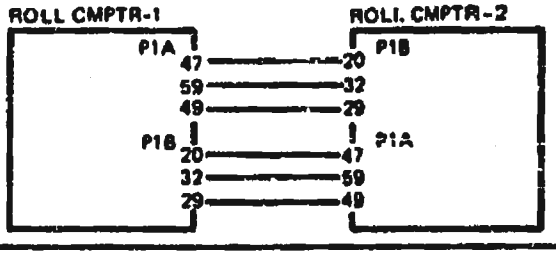
EFFECTIVITY: ALL

001B

15 CONTINUED

CKT #7 ROLL CMPTR X-TALK
(REF. 22-13-00, SCHEM 4)

CKT #8 ROLL CMPTR X-TALK
(REF. 22-13-00, SCHEM 4)



M1-0001-22-1256

R Soft DANA Faults
R Figure 105 (Sheet 12)

R EFFECTIVITY: ALL
R
001B

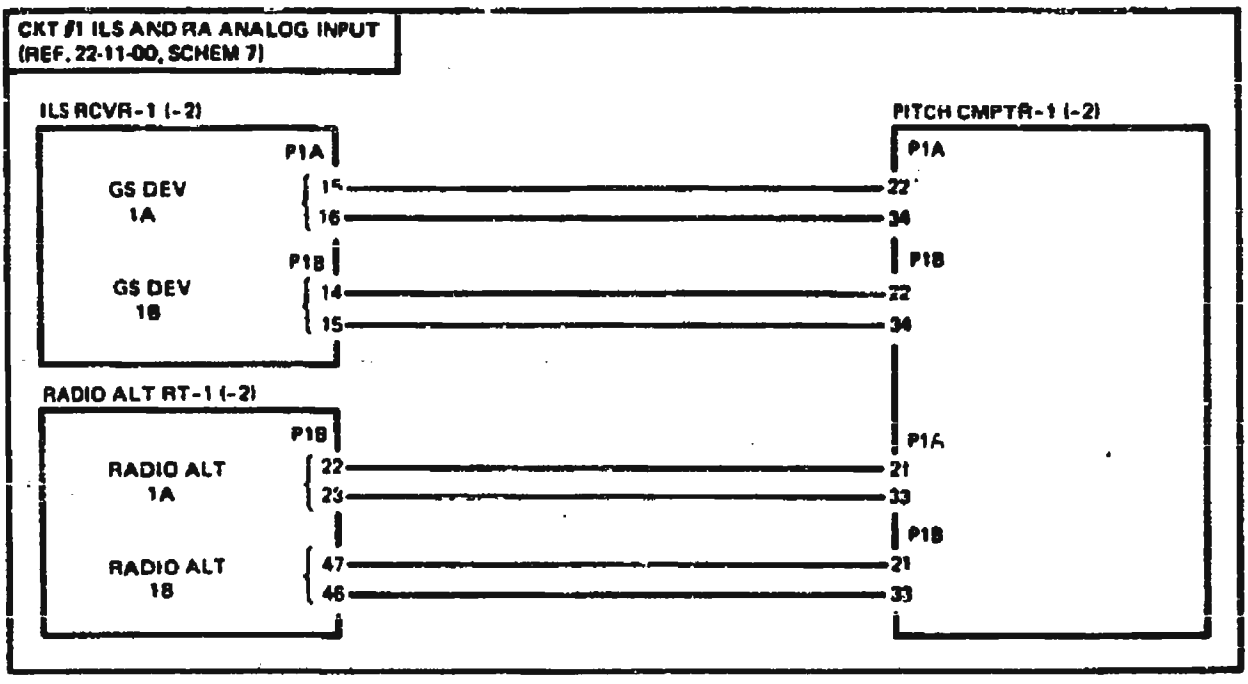
16	DANA LIGHT COMES ON AT A RADIO ALTITUDE GREATER THAN 1500 FT. IF AP BAT HANDLE IS TURNED OFF THEN ON BELOW 1500 FT (RADIO ALTITUDE), DANA DOES NOT COME ON. RADIO ALTITUDE MAY DISAGREE OR GS RAW DATA MAY DISAGREE.

NOTE:
PITCH CMPTR-1 (-2) FIM SET

Chk ckt #1

Ckt #1 chk OK → Replace:
- Pitch cmptr-1 (-2) (22-11-01)
- ILS rcvr-1 (-2) (34-33-01)
- Radio altimeter RT-1 (-2) (34-32-01)

A/C wiring fault → Repair wiring



M1-0001-22-1256

R R Soft DANA Faults
Figure 105 (Sheet 13)

R R 0018 EFFECTIVITY: ALL

DUAL A/L NOT AVAIL (DANA) - ADJUSTMENT AND TEST

1. General

Figures 501 through 504 are used to rapidly detect any obvious system fault which would result in DUAL A/L NOT AVAIL (DANA) annunciation. The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for the appropriate fault isolation procedure. The fault isolation procedures in Paragraph 5 utilize signal intercept cables (T-cables) which permit monitoring of computer input/output functions with the systems fully operational.

2. Equipment and Materials

Radio Altimeter Test Set, Collins Radio 980N-1 with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable Assembly.

R NOTE: To preclude possible radio altimeter mutual interface
R problems, use of the 980N-1 Dual Adapter (active) cable,
R with the radio altimeter test set is recommended.

R If the 980N-1 (passive) Adapter Cable is used for
R autoland testing, temporary shielding of the radio
R altimeter antennas may be required for successful
R completion of the test.

R CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED FOR
R SHIELDING MUST BE SUCH THAT REMOVAL BEFORE FLIGHT IS
R GUARANTEED.

R VOR/ILS Ramp Test Set T-30, or equivalent.

AC/DC Voltmeter - Range 0.01-100 volts.

Breakout Cable Assembly for Yaw Computer, G/ITEL No. 22-00-19 (See Figure 508). (Two Req.)

Breakout Cable Assembly for Pitch and Roll Computers, G/ITEL No. 22-00-20 (See Figure 509). (Two Req.).

3. Referenced Procedures

22-12-00 APFDS Modes of Operation - Maintenance Practices

4. Fault Detection Test

A. Preliminary Procedures

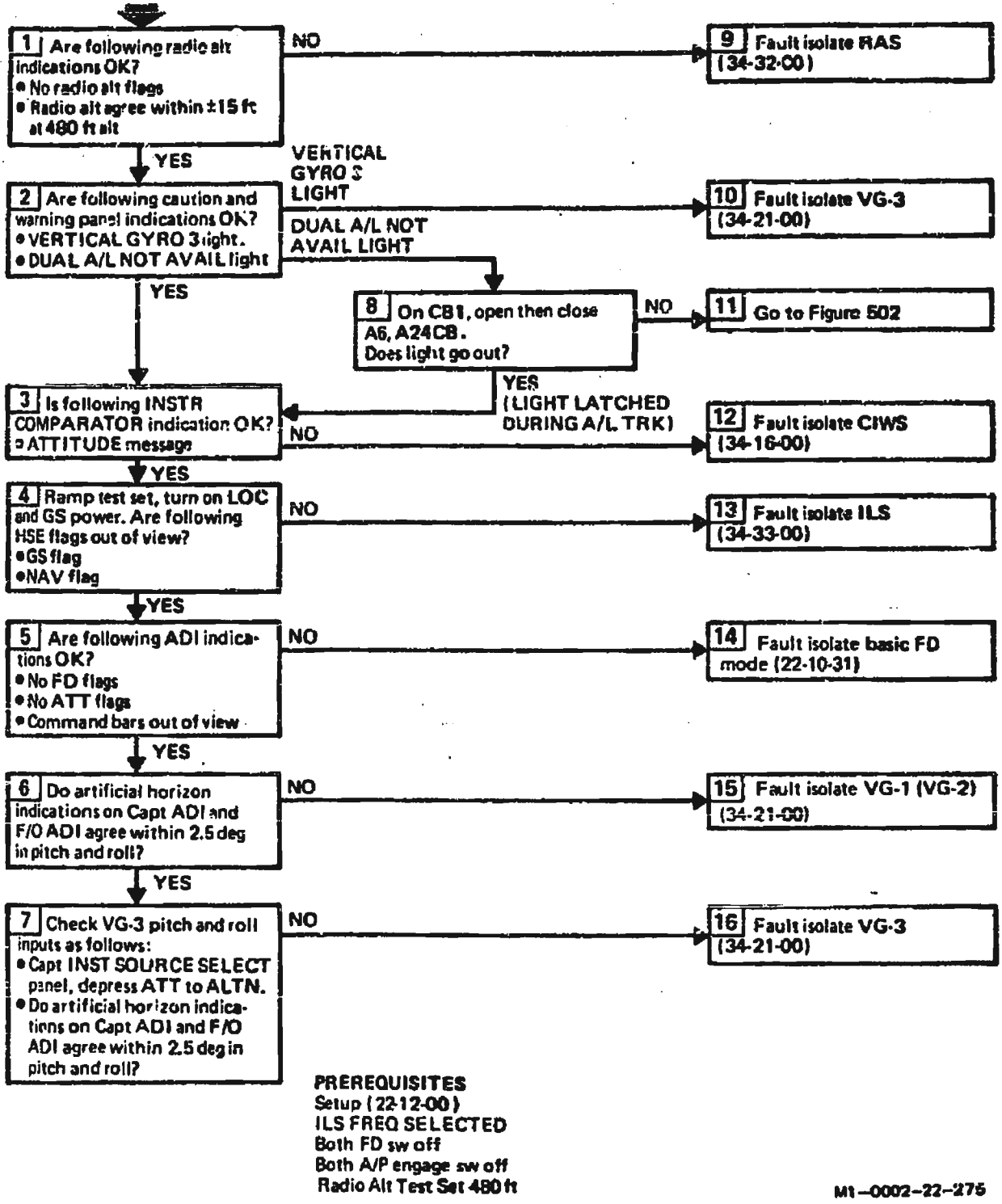
(1) Turn on APFDS as described in AUTOLAND setup of 22-12-00, maintenance practices. Ensure that radio altimeter is set to 480 feet.

B. DUAL A/L NOT AVAIL Test

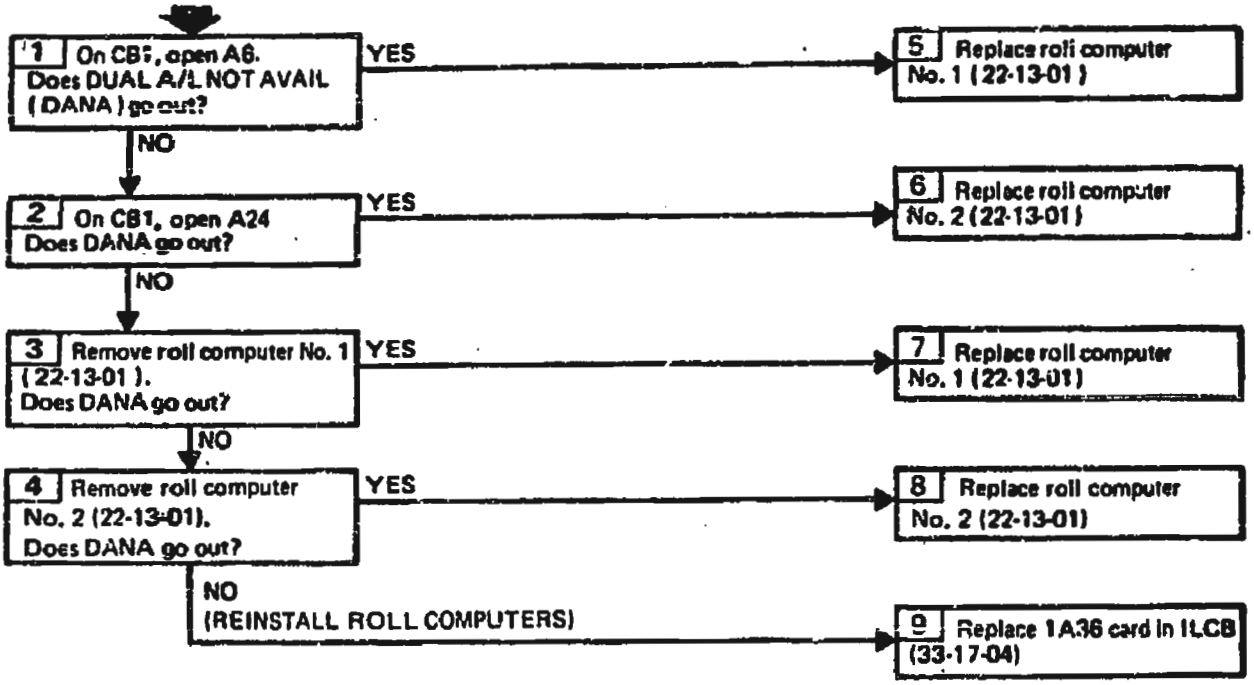
(1) Perform fault isolation of Nav system using cockpit indications as detailed in Figure 501.

(2) Perform fault isolation of autopilot using FIM indications as detailed in Figure 503.

(3) Perform fault isolation of related autopilot faults using indications as detailed in Figure 504.


1 Are following radio alt indications OK?
• No radio alt flags
• Radio alt agree within ±15 ft at 480 ft alt
NO
9 Fault isolate RAS (34-32-00)
YES
2 Are following caution and warning panel indications OK?
• VERTICAL GYRO 3 light.
• DUAL A/L NOT AVAIL light
VERTICAL GYRO 3 LIGHT
10 Fault isolate VG-3 (34-21-00)
DUAL A/L NOT AVAIL LIGHT
YES
8 On CB1, open then close A6, A24CB. Does light go out?
NO
11 Go to Figure 502
YES (LIGHT LATCHED DURING A/L TRK)
3 Is following INSTR COMPARATOR indication OK?
• ATTITUDE message
NO
12 Fault isolate CIWS (34-16-00)
YES
4 Ramp test set, turn on LOC and GS power. Are following HSE flags out of view?
• GS flag
• NAV flag
NO
13 Fault isolate ILS (34-33-00)
YES
5 Are following ADI indications OK?
• No FD flags
• No ATT flags
• Command bars out of view
NO
14 Fault isolate basic FD mode (22-10-31)
YES
6 Do artificial horizon indications on Capt ADI and F/O ADI agree within 2.5 deg in pitch and roll?
NO
15 Fault isolate VG-1 (VG-2) (34-21-00)
YES
7 Check VG-3 pitch and roll inputs as follows:
• Capt INST SOURCE SELECT panel, depress ATT to ALTN.
• Do artificial horizon indications on Capt ADI and F/O ADI agree within 2.5 deg in pitch and roll?
NO
16 Fault isolate VG-3 (34-21-00)
PREREQUISITES
Setup (22-12-00)
ILS FREQ SELECTED
Both FD sw off
Both A/P engage sw off
Radio Alt Test Set 480 ft
M1-0002-22-275

R DUAL A/L NOT AVAIL Light With Nav System Cockpit Fault Problem
R Figure 501


1 On CB?, open A6. Does DUAL A/L NOT AVAIL (DANA) go out?
YES
5 Replace roll computer No. 1 (22-13-01)
NO
2 On CB1, open A24 Does DANA go out?
YES
6 Replace roll computer No. 2 (22-13-01)
NO
3 Remove roll computer No. 1 (22-13-01). Does DANA go out?
YES
7 Replace roll computer No. 1 (22-13-01)
NO
4 Remove roll computer No. 2 (22-13-01). Does DANA go out?
YES
8 Replace roll computer No. 2 (22-13-01)
NO (REINSTALL ROLL COMPUTERS)
9 Replace 1A36 card in ILCB (33-17-04)

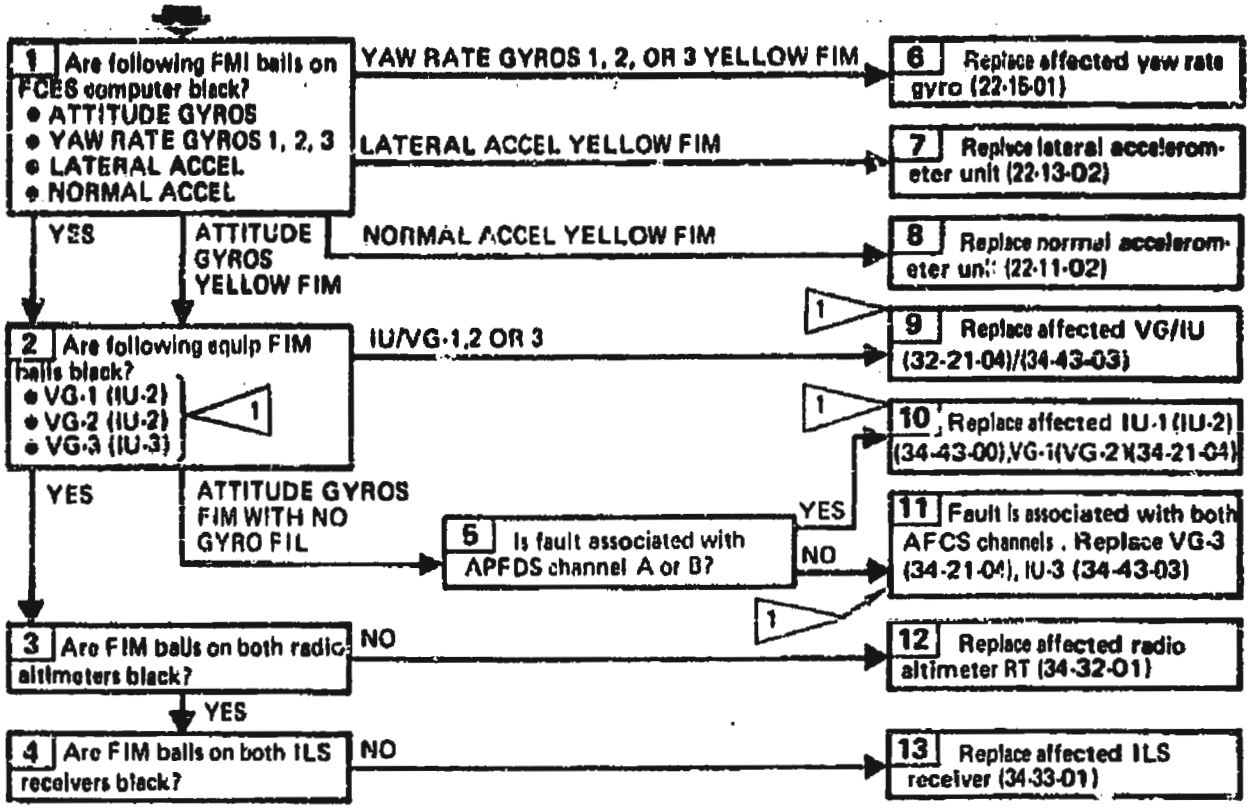
PREREQUISITES
Setup (22-12-00)
BOTH A/P ENGAGE SW OFF

M1-0003-22-247

R DUAL A/L NOT AVAIL Indication Circuit Problem
R Figure 502

EFFECTIVITY: ALL

001B

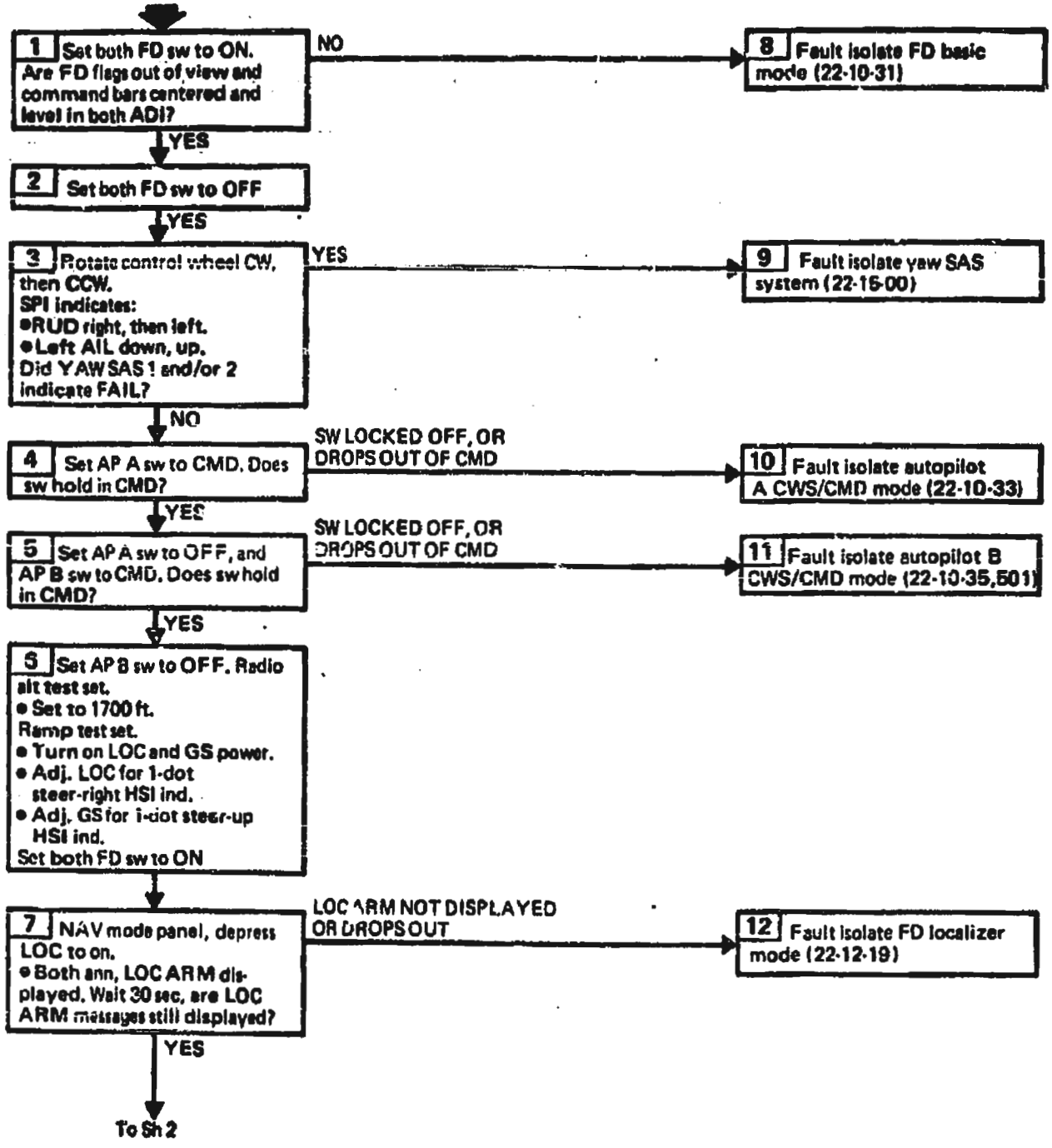

1 Are following FMI bails on FCES computer black?
• ATTITUDE GYROS
• YAW RATE GYROS 1, 2, 3
• LATERAL ACCEL
• NORMAL ACCEL
YAW RATE GYROS 1, 2, OR 3 YELLOW FIM
6 Replace affected yaw rate gyro (22-15-01)
LATERAL ACCEL YELLOW FIM
7 Replace lateral accelerometer unit (22-13-02)
YES
ATTITUDE GYROS YELLOW FIM
NORMAL ACCEL YELLOW FIM
8 Replace normal accelerometer unit (22-11-02)
2 Are following equip FIM bails black?
• VG-1 (IU-2)
• VG-2 (IU-2)
• VG-3 (IU-3)
1
IU/VG-1,2 OR 3
1
9 Replace affected VG/IU (32-21-04)/(34-43-03)
1
10 Replace affected IU-1 (IU-2) (34-43-00), VG-1 (VG-2) (34-21-04)
YES
ATTITUDE GYROS FIM WITH NO GYRO FIL
6 Is fault associated with APFDS channel A or B?
YES
NO
11 Fault is associated with both AFCS channels. Replace VG-3 (34-21-04), IU-3 (34-43-03)
1
3 Are FIM bails on both radio altimeters black?
NO
12 Replace affected radio altimeter RT (34-32-01)
YES
4 Are FIM bails on both ILS receivers black?
NO
13 Replace affected ILS receiver (34-33-01)

NOTE

1 IU-AIRCRAFT WITH INS
VG-AIRCRAFT WITH VGS

M1-0001-22-1896

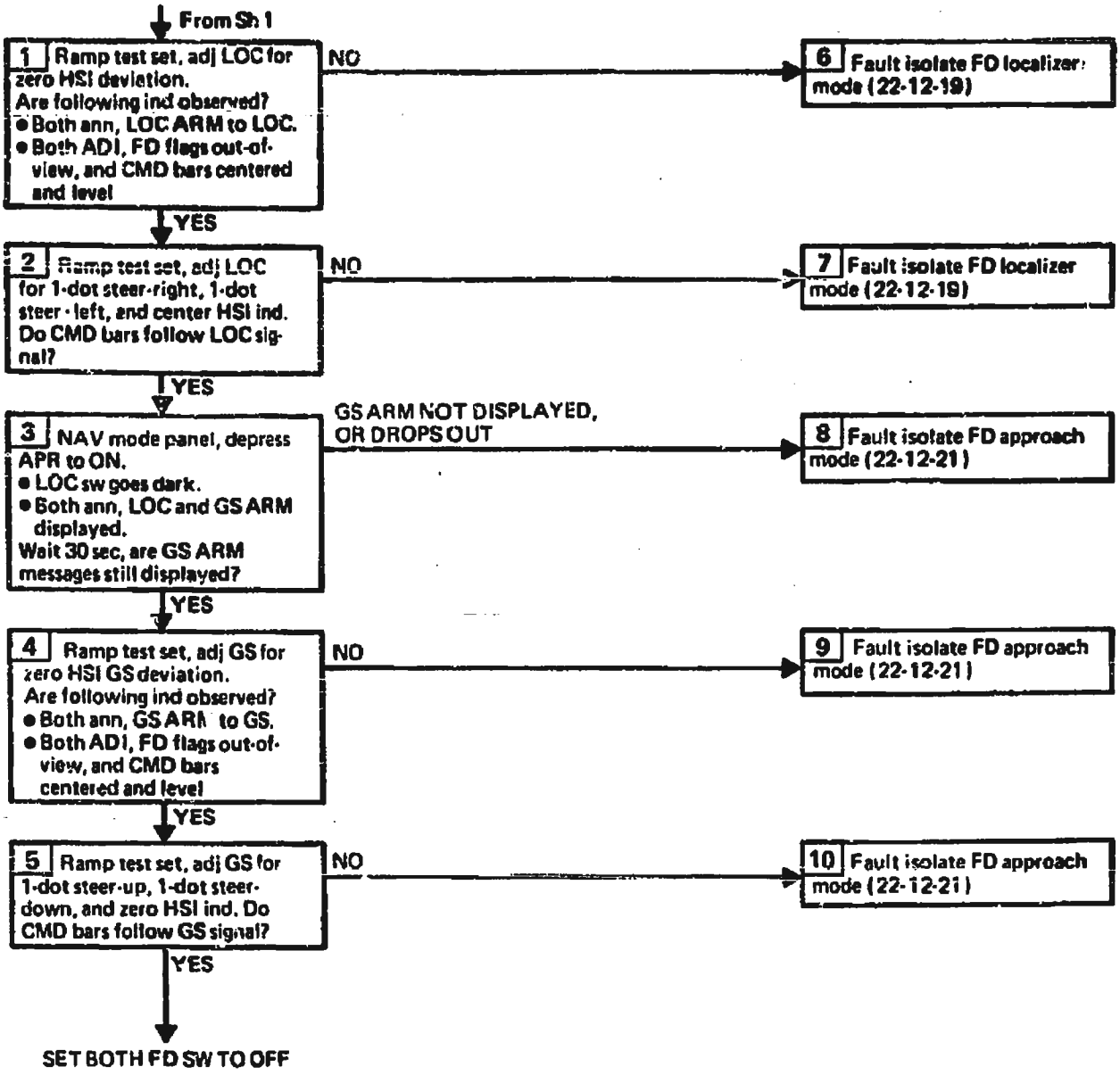
R DUAL A/L NOT AVAIL Light With Related FIM Problem
R Figure 503


1 Set both FD sw to ON. Are FD flags out of view and command bars centered and level in both ADI?
NO
8 Fault isolate FD basic mode (22-10-31)
YES
2 Set both FD sw to OFF
YES
3 Rotate control wheel CW, then CCW. SPI indicates: •RUD right, then left. •Left AIL down, up. Did YAW SAS 1 and/or 2 indicate FAIL?
YES
9 Fault isolate yaw SAS system (22-15-00)
NO
4 Set AP A sw to CMD. Does sw hold in CMD?
SW LOCKED OFF, OR DROPS OUT OF CMD
10 Fault isolate autopilot A CWS/CMD mode (22-10-33)
YES
5 Set AP A sw to OFF, and AP B sw to CMD. Does sw hold in CMD?
SW LOCKED OFF, OR DROPS OUT OF CMD
11 Fault isolate autopilot B CWS/CMD mode (22-10-35,501)
YES
6 Set AP B sw to OFF. Radio alt test set. • Set to 1700 ft. Ramp test set. • Turn on LOC and GS power. • Adj. LOC for 1-dot steer-right HSI ind. • Adj. GS for 1-dot steer-up HSI ind. Set both FD sw to ON
7 NAV mode panel, depress LOC to on. • Both ann, LOC ARM displayed. Wait 30 sec, are LOC ARM messages still displayed?
LOC ARM NOT DISPLAYED OR DROPS OUT
12 Fault isolate FD localizer mode (22-12-19)
YES
To Sh 2

M1-0002-22-249

R DUAL A/L NOT AVAIL Light With FD or Yaw SAS Fault Problem
R Figure 504 (Sheet 1)

EFFECTIVITY: ALL


From Sh 1
1 Ramp test set, adj LOC for zero HSI deviation. Are following ind observed?
• Both ann, LOC ARM to LOC.
• Both ADI, FD flags out-of-view, and CMD bars centered and level
NO
6 Fault isolate FD localizer mode (22-12-19)
YES
2 Ramp test set, adj LOC for 1-dot steer-right, 1-dot steer-left, and center HSI ind. Do CMD bars follow LOC signal?
NO
7 Fault isolate FD localizer mode (22-12-19)
YES
3 NAV mode panel, depress APR to ON.
• LOC sw goes dark.
• Both ann, LOC and GS ARM displayed.
Wait 30 sec, are GS ARM messages still displayed?
GS ARM NOT DISPLAYED, OR DROPS OUT
8 Fault isolate FD approach mode (22-12-21)
YES
4 Ramp test set, adj GS for zero HSI GS deviation. Are following ind observed?
• Both ann, GS ARM to GS.
• Both ADI, FD flags out-of-view, and CMD bars centered and level
NO
9 Fault isolate FD approach mode (22-12-21)
YES
5 Ramp test set, adj GS for 1-dot steer-up, 1-dot steer-down, and zero HSI ind. Do CMD bars follow GS signal?
NO
10 Fault isolate FD approach mode (22-12-21)
YES
SET BOTH FD SW TO OFF

PREREQUISITES
Setup (22-12-00)
Both FD sw OFF
Both AP engage sw OFF
Radio Alt Test Set 1700 ft

EM1-0100-22-264

R DUAL A/L NOT AVAIL Light With FD or Yaw SAS Fault Problem
R Figure 504 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

R NOTE: Mode messages and warning indications which are
R displayed during this test, other than those
R which are specifically called for, may be
R ignored.

R (4) Ensure that radio altitude is approximately 1700 feet.

R (5) On CB1, open A6 and A24 circuit breakers.

R (6) Close A6 and A24 circuit breakers.

R (7) On FCES panel, cycle yaw SAS 1 and 2 switchlights to
R OFF, then on.

R (8) On FCES panel, verify that PITCH TRIM 1 and 2
R switchlights are on (dark).

R NOTE: Unless otherwise specified, allow approximately
R 10 seconds for DANA annunciation after
R performing each step of the following procedure.

R (9) Set AP switch A to CWS. Is DANA annunciated?

R Yes: Go to Fault (1).

R No: Go to Step (10).

R (10) Pull aft on Capt control wheel until AP LIMIT message
R is displayed on both AFCS WARNING indicators. Hold for
R approximately 10 seconds. Slowly release force. Is
R DANA annunciated?

R Yes: Go to Fault (2).

R No: Go to Step (11).

R (11) Rapidly turn Capt control wheel fully clockwise and
R hold until next step. Is DANA annunciated within 10
R seconds?

R Yes: Go to Fault (3).

R No: Go to Step (12).

R (12) Set AP switch A to OFF. Slowly release control wheel
R force. Set AP switch B to CWS. Push forward on
R control wheel until AP LIMIT message is displayed on
R AFCS WARNING indicators. Hold for approximately 10
R seconds. Slowly release force. Is DANA annunciated?

R Yes: Go to Fault (4).

R No: Go to Step (13).

R (13) Rapidly turn control wheel fully counterclockwise and
R hold until next step. Is DANA annunciated within 10
R seconds?

R Yes: Go to Fault (5).

R No: Go to Step (14).

R (14) Set AP switch B to OFF. Slowly release control wheel
R force. Set AP switch A to CMD. Set both VHF NAV
R frequency selectors to 108.0 MHz. Wait one full
R minute. Is DANA annunciated?

R Yes: Go to Fault (6).

R No: Go to Step (15).

R (15) Set both VHF NAV frequency selectors to 108.1 MHz.
R Wait one full minute. Is DANA annunciated?

R Yes: Go to Fault (7).

R No: Go to Step (16).

R (16) Using ILS test set, adjust LOC and GS for zero HSI
R deviation. On NAV MODE panel, depress A/L switchlight
R to on. Wait until A/L ARM message is displayed on both
R AFCS MODES annunciators. Is DANA annunciated?

R Yes: Go to Fault (8).

R No: Go to Step (17).

R (17) Slowly vary LOC beam deviation to one-dot left, then
R one-dot right, and then back to zero. Is DANA
R annunciated?

R Yes: Go to Fault (9).

R No: Go to Step (18).

R (18) Slowly vary GS beam deviation to one-dot up, then
R one-dot down, and then back to zero. Is DANA
R annunciated?

R Yes: Go to Fault (10).

R No: Go to Step (19).

R (19) Reduce radio altitude to 1300 feet and wait until A/L
R ARM messages on AFCS MODES indicators change to A/L.
R Is DANA annunciated?

R Yes: Go to Fault (11).

R No: Go to Step (20).

R (20) Set AP switch B to CMD. Set AP switch A to OFF. Is
R DANA annunciated?

R Yes: Go to Fault (12).

R No: Go to Step (21).

R (21) Slowly vary LOC beam deviation to one dot left. Wait 2
R full minutes and then establish zero-beam deviation.
R Wait 1 full minute and then establish one-dot right
R beam deviation. Wait 2 full minutes and then establish
R zero beam deviation. Is DANA annunciated?

R Yes: Go to Fault (13).

R No: Go to Step (22).

R (22) Slowly vary GS-beam deviation to one dot-up, then
R one-dot down, and then back to zero. Is DANA
R annunciated?

R Yes: Go to Fault (14).

R No: Go to Step (23).

R (23) Reduce radio altitude to 130 feet. Wait until ALN ARM
R messages change to ALIGN messages on AFCS MODES
R annunciators. Is DANA annunciated?

R Yes: Go to Fault (15).

R No: Go to Step (24).

R (24) Slowly vary LOC-beam deviation to produce a one-bar
R width steer right indication on Capt HSI in
R approximately 5 seconds. (One-bar width = left side of
R bar aligned with the right side of course
R (Note: Too rapid a variation of LOC input may result
R in a DANA fault indication.)Wait 5 seconds. Slowly
R vary LOC-beam deviation to produce a zero indication on
R Capt HSI. Wait 5 seconds. Repeat above procedure to
R establish a one bar-width steer left indication for 5
R seconds and then establish zero deviation. Wait 5

R seconds. Is DANA annunciated during the above
R procedure?

R Yes: Go to Fault (16).

R No: Go to Step (25).

R (25) In FESC, remove AFCS/MLG Accessory Unit. Smoothly
R reduce radio altitude from 130 feet to zero feet within
R a period of 8 to 12 seconds. Is DANA annunciated?

R Yes: Go to Fault (17).

R No: Install AFCS/MLG Accessory Unit. Go to Step (26).

R (26) Set AP switch B to OFF. On galley ceiling zone 135,
R carefully remove normal accelerometer unit from mount
R with cables connected and tilt the unit approximately
R 90 degrees in nose-up direction. Hold unit in this
R position. Avoid moving unit suddenly. Set AP switch A
R to CWS. Is DANA annunciated?

R Yes: Set AP switch A to OFF, temporarily install unit,
R and go to Fault (18).

R No: Set AP switch A to OFF, permanently install unit,
R and go to Step (27).

R (27) On galley ceiling zone 135, carefully remove lateral
R accelerometer unit from mount with cables connected and
R tilt the unit approximately 90 degrees in right wing
R down direction. Avoid moving unit suddenly. Set AP
R switch A to CWS. Is DANA annunciated?

R Yes: Set AP switch A to OFF, temporarily install unit,
R and go to Fault (19).

R No: Set AP switch A to OFF and permanently install
R unit.

R C. Test Completion

R (1) In FESC, make certain that all T-cables (if installed)
R are removed and that all computers are securely mounted
R in racks.

R (2) Make certain that normal or lateral accelerometers, if
R removed, are securely mounted and cables are connected.

R (3) Disassemble radio altimeter test setup as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) Disconnect test set cable plugs from radio altimeter RT No. 1 and 2 TEST connectors.

(c) Cap TEST connectors.

(d) Close D4 and D22 circuit breakers.

(e) Depress RESET pushbutton on front of radio altimeter RT No. 1 and 2 to reset fault indicators tripped during test.

(4) Engage dual-channel A/L rollout mode as follows:

(a) Set FD switches A and B to ON.

(b) Using ILS test set, establish zero LOC and GS beam deviation indications on HSI.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN, FLARE and ROLLOUT messages are displayed.

On both AFCS WARNING indicators, no messages are displayed. On CAWP, DANA message is not displayed. Stabilizer trim wheels do not rotate (some wheel "creep" may occur).

(5) Set FD switches A and B to off.

(6) Disengage autopilot by depressing AP DISC switch on either control wheel.

(7) Position control column to obtain a +1 degree STAB indication on SPI.

(8) Retract flaps (after clearance) to zero degrees.

R R (9) On FCES computer, depress RESET pushbutton to reset FIM indicators.

R (10) Turn off hydraulic power (Ref. 29-11-00).

R (11) Turn off electrical power (Ref. 24-00-00).

R 5. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing
R the Faults Detection Test. It also lists the fault number
R in Paragraph 5B for the appropriate fault isolation
R procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential
R fault, references to applicable maintenance manual
R schematics are given in Table 502. For fault isolating
R aircraft wiring, use tables on schematics for a listing of
R applicable wiring diagram manual.

R DUAL A/L NOT AVAIL Fault Isolation Summary
R Table 501

TEST REF.	FAULT	FAULT NO.
4B(9)	DUAL A/L NOT AVAIL (DANA) light with AP A to CWS	(1)
4B(10)	DANA When Pulling Control Wheel in CWS Mode	(2)
4B(11)	DANA When Turning Control Wheel Clockwise in CWS Mode	(3)
4B(12)	DANA When Pushing Control Wheel in CWS Mode	(4)
4B(13)	DANA When Turning Control Wheel Counterclockwise in CWS Mode	(5)
4B(14)	DANA When VOR Freq Tuned	(6)
4B(15)	DANA When Switching from VOR Freq to ILS Freq.	(7)
4B(16)	DANA After A/L ARM	(8)
4B(17)	DANA light during LOC deviation (AP A)	(9)
4B(18)	DANA light during GS deviation (AP A)	(10)
4B(19)	DANA light below 1400 ft. radio alt (AP A)	(11)
4B(20)	DANA light with AP B to CMD	(12)

DUAL A/L NOT AVAIL Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(21)	DANA light during LOC deviation (A/L Track)	(13)
4B(22)	DANA light during GS deviation (A/L Track)	(14)
4B(23)	DANA light at ALIGN	(15)
4B(24)	DANA light during LOC deviation in ALIGN mode	(16)
4B(25)	DANA light with change in radio alt	(17)
4B(26)	DANA light with normal accelerometer input	(18)
4B(27)	DANA light with lateral accelerometer input	(19)

Schematics for Fault Isolation of DUAL A/L NOT AVAIL Light Problem
Table 502

	TITLE	LOCATION
R	A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic	22-13-00, Schem 11
R	Pitch Computer No First Fail and Pitch A/L Available Schematic	22-11-00, Schem 17
R	Yaw SAS Engage and Annunciator Schematic	22-15-00 Schem 5

B. DUAL A/L NOT AVAIL (DANA) Faults

The following abbreviations are used in this section:

Engage A/L - On NAV MODE panel, depress A/L switchlight to on.

Wait for A/L track - Wait until A/L ARM messages on AFCS MODES indicators change to A/L (about 35 seconds after engaging A/L with one AP engage switch set to CMD).

Install pitch/roll computer No. 1 / No. 2 T-cables - Use G/ITEL No. 22-00-20 breakout cable assembly for pitch and roll computers. Open A6 circuit breaker on CB1 when installing or removing T-cables on either pitch or roll computer No. 1. Open A24 circuit breaker on CB1 when installing or removing T-cables on either pitch or roll computer No. 2.

Install yaw computer No. 1 / No. 2 T-cables - Use G/ITEL No. 22-00-19 breakout cable assembly for yaw computers. Open A5 circuit breaker on CB1 when installing or removing T-cables on yaw computer No. 1. Open A23 circuit breaker for yaw computers No. 2 T-cable installation.

(1) Fault: DUAL A/L NOT AVAIL (DANA) when AP A to CWS.

(a) Faulted Channel

Reduce radio altitude to 1300 feet. Set AP A to CMD. Engage A/L. Wait for A/L Track. Set AP A to OFF. On CB1, open A6. Is DANA extinguished?

Yes: Fault affects Capt channel. Go to Step (c).

No: Fault affects F/O or both channels. Go
R to next Step (b).

R (b) On CB1, open A24. Close A6 and A24. Set AP A to CMD. Engage A/L. Wait for A/L track. Set AP A to OFF. Open A24. Is DANA extinguished?

R Yes: Fault affects F/O channel. Go to Step
R (i).

R No: Fault affects both channels. Go to Step
R (p).

R (c) Capt Channel - Faulted Axis

Install roll computer No. 1 T-cables. Close A6. Set AP A to CWS. Check for +28VDC to ground at P1A-57 (RADIO ALTITUDE AFCS VALID 1A). Is voltage present?

R Yes: Go to Step (d).

No: Replace radio altimeter No. 1 RT (Ref 34-32-01).

R (d) Check for +28VDC to ground at P2B-13 (PITCH A/L AVAIL). Is voltage present?

R Yes: Yaw or roll axis fault. Go to Step (e).

R No: Pitch axis fault. Go to Step (f).

R (e) Check for +28VDC to ground at P1B-11 (YAW CAT III AVAIL). Is voltage present?

R Yes: Roll axis fault. Go to Step (g).

R No: Yaw axis fault. Go to Step (h).

R (f) Capt Channel - Pitch Axis - Faulted Component

Open A6. Remove roll computer No. 1 T-cables and install behind pitch computer No. 1. Close A6. Set AP A to CWS. Check for voltages listed in Column I of Figure 505. Are voltages correct?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace component which provides signal.

R (g) Capt Channel - Roll Axis - Faulted Component

Check for voltages listed in Column I of Figure 506. Are voltages correct?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Replace component which provides signal.

R (h) Capt Channel - Yaw Axis - Faulted Component

On CB1, open A5. Install yaw computer No. 1 T-cables. Close A5 and wait one minute. Cycle

YAW SAS. Set AP A to CWS. Check for yaw rate gyro and yaw rate gyro No. 3 voltages listed in Column I of Figure 5C7. Are voltages correct?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Replace yaw rate gyro (Ref. 22-15-02) which provides signal.

(i) F/O Channel - Faulted Axis

Install roll computer No. 2 T-cables. Close A24. Set AP A to CWS. Check for +28VDC to ground at P1A-57 (RADIO ALTITUDE AFCS VALID 2A). Is voltage present?

Yes: Go to next Step.

No: Replace radio altimeter No. 2 (Ref. 34-32-01).

(j) Check for +28VDC to ground at P2B-13 (PITCH A/L AVAIL). Is voltage present?

Yes: Yaw or roll axis fault. Go to Step (k).

No: Pitch axis fault. Go to Step (l).

(k) Check for +28VDC to ground at P1B-11 (YAW CAT III AVAIL). Is voltage present?

R Yes: Roll axis fault. Go to Step (m).

R No: Yaw axis fault. Go to Step (n).

(l) F/O Channel - Pitch Axis - Faulted Component

Open A24. Remove roll computer No. 2 T-cables and install behind pitch computer No. 2. Close A24. Set AP A to CWS. Check for voltages listed in Column I of Figure 505. Are voltages correct?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace component which provides signal.

(m) F/O Channel - Roll Axis - Faulted Component

Check for voltages listed in Column I of Figure 506. Are voltages correct?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace component which provides signal.

(n) F/O Channel - Yaw Axis - Component Fault

On CB1, open A23. Install yaw computer No. 2 T-cables. Close A23 and wait one minute. Cycle YAW SAS. Set AP A to CWS. Check for yaw rate gyro and yaw rate gyro No. 3 voltages listed in Column I of Figure 507. Are voltages correct?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01).

No: Replace yaw rate gyro (Ref. 22-15-02) which provides incorrect signal.

(p) Both Channels - Faulted Axis

Open A6. Install roll computer No. 1 T-cables. Close A6 and A24. Set AP A to CWS. Check for +28VDC to ground at P3B-13 (PITCH A/L AVAIL). Is voltage present?

Yes: Yaw or roll axis fault. Go to Step (q).

No: Pitch axis fault. Go to Step (r).

(q) Check for +28VDC to ground at P1B-11 (YAW CAT III AVAIL). Is voltage present?

Yes: Roll axis fault. Go to Step (t).

No: Yaw axis fault. Go to Step (v).

(r) Both Channels - Pitch Axis - Faulted Component

Open A6. Remove roll computer No. 1 T-cables and install behind pitch computer No. 1. Close A6. Set AP A to CWS. Check for voltages listed in Column I of Figure 505. Are voltages correct?

Yes: Go to Step (s).

No: Replace component which provides signal.

(s) Open A6 and A24. Remove pitch computer No. 1 T-cables and install behind pitch computer No. 2. Close A6 and A24. Set AP A to CWS. Check for

voltages listed, in Column I of Figure 505. Are voltages correct?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2 with original pitch computer No. 1.

No: Replace component which provides incorrect signal.

(t) Both Channels - Roll Axis - Faulted Component

Check for lateral accelerometer No. 3 and vertical gyro No. 3 voltages listed in Column I of Figure 506. Are voltages correct?

Yes: Go to next (u).

No: Replace component which provides incorrect signal.

(u) Open A6 and A24. Remove roll computer No. 1 T-cables and install behind roll computer No. 2. Close A6 and A24. Set AP A to CWS. Check for lateral accelerometer No. 3 and vertical gyro No. 3 voltages listed in Column I of Figure 506. Are voltages correct?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 with original roll computer No. 1.

No: Replace component which provides incorrect signal.

(v) Both Channels - Yaw Axis - Faulted Component

On CB1, open A5. Install yaw computer No. 1 T-cables. Close A5 and wait one minute. Cycle YAW SAS. Set AP A to CWS. Check for voltages listed in Column I of Figure 507. Are voltages correct?

Yes: Go to Step (w).

No: Replace component which provides incorrect signal.

(w) On CB1, open A5 and A23. Remove yaw computer No. 1 T-cables and install behind yaw computer No. 2.

Close A5 and A23. Cycle YAW SAS. Set AP A to CWS. Check for voltages listed in Column I of Figure 507. Are voltages correct?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01). If problem persists, replace yaw computer No. 2 with original yaw computer No. 1.

R
R No: Replace component which provides incorrect signal.

(2) Fault: DANA When Aft Force Applied to Control Wheel

(a) Faulted Axis and Component

Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2 with original pitch computer No. 1.

---

(3) Fault: DANA When Control Wheel Turned Clockwise

(a) Cycle YAW SAS. On CB1, open A23.

On FCES panel, verify YAW SAS 2 FAIL legend. Turn control wheel fully clockwise. Does YAW SAS 1 indicate FAIL?

Yes: Fault affects Capt yaw axis. Go to Step (c).

No: Fault affects F/O or both channels. Go to Step (b).

(b) Close A23. Wait one full minute. Cycle yaw SAS. On CB1, open A5. Verify yaw SAS 1 FAIL legend. Turn control wheel fully clockwise. Does yaw SAS 2 indicate FAIL?

R Yes: Fault affects F/O yaw axis. Go to Step
R (d).

R No: Fault affects both channels. Go to Step
R (e).

(c) Capt Channel - Faulted Axis and Component

On CB1, open A5 and A6. Remove roll computer No. 1. Install yaw computer No. 1 T-cables. Close A5. Adjust ROLL (aileron) trim wheel on cockpit center console for maximum right wing down trim. Check for AILERON POSITION voltages listed in Column II of Figure 507. Are channel A and B voltages approximately the same?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01). If problem persists, replace roll computer No. 1 (22-13-01).

No: Replace aileron dual position transducer No. 1 (Ref. 22-13-03).

R (d) F/O Channel - Faulted Axis and Component

On CB1, open A23 and A24. Remove roll computer No. 2. Install yaw computer No. 2 T-cables. Close A23. Adjust ROLL trim wheel on cockpit center console for maximum right wing down trim. Check for AILERON POSITION voltages listed in Column II of Figure 507. Are channel A and B voltages approximately the same?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01). If problem persists, replace roll computer No. 2 (22-13-01).

No: Replace aileron dual position transducer No. 2 (Ref. 22-13-03).

R (e) Both Channels - Faulted Axis and Component

Adjust ROLL trim wheel on cockpit center console for maximum right wing down trim. On CB1, open A6 and A24. Remove roll computers No. 1 and No. 2. Measure and note aileron position AC ANALOG voltage between roll computer No. 1 rack connector P1A-53 and P1A-65. Measure equivalent voltage between roll computer No. 2 rack connector P1A-53 and P1A-65. Are voltages approximately equal?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 with original roll computer No. 1. If problem persists, replace yaw computer No. 1 (Ref. 22-15-01), then yaw computer No. 2.

No: Perform aileron position rigging procedure (Ref. 22-13-03).

---

(4) FAULT: DANA When Forward Force Applied to Control Wheel

(a) Faulted Axis and Component

Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2 with original pitch computer No. 1.

R ---

R (5) FAULT: DANA When Control Wheel Rotated Counterclockwise

R (a) Roll Axis - Faulted Channel and Component

R Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 with original roll computer No. 1.

R ---

R (6) FAULT: DANA When 108.0 MHz (VOR Freq) Tuned

R (a) Roll Axis - Faulted Channel and Component

R Set AP A to OFF. Set both VHF/NAV panels to 108.1 MHz. Set AP A to CWS. Set Capt VHF/NAV panel to 108.0 MHz. Is DANA annunciated?

R Yes: Replace ILS receiver No. 1 (Ref. 34-33-01). If problem persists, replace VHF NAV accessory unit (Ref. 34-55-06) and then replace roll computer No. 1 (Ref. 22-13-01).

R No: Replace ILS receiver No. 2 (Ref. 34-33-01). If problem persists, replace VHF NAV accessory unit (Ref. 34-55-06) and than replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (7) FAULT: DANA When 108.1 MHz Tuned

R (a) Roll Axis - Faulted Channel and Component

R Set AP A to OFF. Set both VHF/NAV panels to 108.0 MHz. Set AP A to CWS. Set Capt VHF/NAV panel to 108.1 MHz. Is DANA annunciated?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).

R No: Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (8) Fault: DANA When A/L ARM Engaged

R (a) Pitch Axis - Faulted Channel and Component

R Replace pitch computer No. 1 (Ref. 22-11-01). If
R problem persists, replace pitch computer No. 2
R with original pitch computer No. 1.

R ---

R (9) Fault: DANA Annunciated With LOC Deviation

R (a) Faulted Channel

R Reduce radio altitude to 1300 feet. Wait until
R A/L Track. Set AP A to OFF. On CB1, open A6. Is
R DANA annunciation extinguished?

R Yes: Fault affects roll axis of Capt channel.
R Go to Step (b).

R No: Fault affects roll axis of F/O channel.
R Go to Step (c).

R (b) Capt Channel - Roll Axis - Faulted Component

R Install roll computer No. 1 T-cables. Establish
R 1-dot LOC beam deviation in direction which
R resulted in DANA annunciation. Check for LOC HI
R LEVEL DEV voltages listed in Column II of Figure
R 506. Are voltages equal?

R Yes: Replace roll computer No. 1 (Ref.
R 22-13-01).

R No: Replace ILS receiver No. 1 (Ref.
R 34-33-01).

R (c) F/O Channel - Roll Axis - Faulted Component

R On CB1, open A24. Install roll computer No. 2
R T-cables. Establish 1-dot LOC beam deviation in
R direction which resulted in DANA annunciation.
R Check for LOC HI LEVEL DEV voltages listed in
R Column II of Figure 506. Are voltages equal?

R Yes: Replace roll computer No. 2 (Ref.
R 22-13-01).

R No: Replace ILS receiver No. 2 (Ref.
R 34-33-01).

R ---

R (10) Fault: DANA Annunciated with GS Deviation

(a) Faulted Channel

Reduce radio altitude to 1300 feet. Wait until A/L Track. Set AP A to OFF. On CB1, open A6. Is DANA annunciation extinguished?

Yes: Fault affects pitch axis of Capt channel. Go to Step (b).

No: Fault affects pitch axis of F/O channel. Go to Step (c).

(b) Capt Channel - Pitch Axis - Faulted Component

Install pitch computer No. 1 T-cables. Establish 1-dot GS-beam deviation in direction which resulted in DANA annunciation. Check for GS HI LEVEL DEV voltages listed in Column I of Figure 505. Are voltages equal?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace ILS receiver No. 1 (Ref. 34-33-01).

(c) F/O Channel - Pitch Axis - Faulted Component

On CB1, open A24. Install pitch computer No. 2 T-cables. Establish 1-dot GS-beam deviation in direction which resulted in DANA annunciation. Check for GS HI LEVEL DEV voltages listed in Column I of Figure 505. Are voltages equal?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace ILS receiver No. 2 (Ref. 34-33-01).

---

(11) Fault: DANA Annunciated at 1300 Feet

(a) Faulted Channel

Set AP A to off. On CB1, open A6. Is DANA annunciation extinguished?

R Yes: Fault affects Capt channel. Go to Step
R (c).

No: Fault affects F/O or both channels. Go to Step (b).

(b) Close A6. Sep AP A to CMD. Engage A/L. Wait until A/L Track. Set AP A to OFF. On CB1, open A24. Is DANA annunciation extinguished?

Yes: Fault affects F/O channel. Go to Step (h).

No: Fault affects both channels. Go to Step (k).

(c) Capt Channel - Faulted Axis

Install roll computer No. 1 T-cables. Close A6. Set AP A to CMD. Engage A/L. Wait until A/L Track. Check for +28VDC to ground at P1B-11 (YAW CAT III AVAIL). Is voltage present?

Yes: Pitch or roll axis fault. Go to Step (d).

No: Yaw axis fault. Go to Step (g).

(d) Check for +28VDC to ground at P2B-13 (PITCH A/L AVAIL). Is voltage present?

Yes: Roll axis fault. Go to Step (e).

No: Pitch axis fault. Go to Step (f).

(e) Capt Channel - Roll Axis - Faulted Component

Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 with previously removed roll computer No. 1.

(f) Capt Channel - Pitch Axis - Faulted Component

Set AP A to OFF. On CB1, open A6. Remove roll computer No. 1 T-cables and install behind pitch computer No. 1. Close A6. Set AP A to CMD. Engage A/L. Wait until A/L track. Check for +28 VDC to ground at P2A-18 (HIGH AUTH HOOK MON). Is voltage present?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2 with previously removed pitch computer No. 1.

No: Problem in HIGH AUTH HOOK MON circuit (Ref. 22-11-00, SCHEM 9).

(g) Capt Channel - Yaw Axis - Faulted Component

Set AP A to OFF. On CB1, open A5. Install yaw computer No. 1 T-cables. Close A5 and wait one full minute. Cycle yaw SAS. Set AP A to CMD. Engage A/L. Wait until A/L track. Check for +28 VDC to ground at P2A-35 (RUDDER HOOK MON). Is voltage present?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01). If problem persists, replace yaw computer No. 2 with previously removed yaw computer No. 1.

No: Problem in RUDDER HOOK MONITOR circuit (Ref. 22-15-00, SCHEM 5).

(h) F/O Channel - Faulted Axis

Install roll computer No. 2 T-cables. Close A24. Set AP A to CMD. Engage A/L. Wait until A/L Track. Check for +28VDC to ground at P1B-11 (YAW CAT III AVAIL). Is voltage present?

R Yes: Roll axis fault. Go to Step (i).

R No: Yaw axis fault. Go to Step (j).

(i) F/O Channel - Roll Axis - Faulted Component

Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace roll computer No. 1 with previously removed roll computer No. 2.

(j) F/O Channel - Yaw Axis - Faulted Component

Replace yaw computer No. 2 (Ref. 22-15-01). If problem persists, replace yaw computer No. 1 with previously removed yaw computer No. 2.

(k) Both Channels - Faulted Axis

On CB1, open A6. Install roll computer No. 1 T-cables. Close A6 and A24. Set AP A to CMD. Engage A/L. Wait until A/L Track. Check for +28VDC to ground at P2B-13 (PITCH A/L AVAIL). Is voltage present?

R Yes: Yaw axis fault. Go to Step (m).

No: Pitch axis fault. Go to Step (l).

(l) Both Channels - Pitch Axis - Faulted Component

Replace pitch computer No. 1 (Ref. 22-11-00. If problem persists, replace pitch computer No. 2 with previously removed pitch computer No. 1.

(m) Both Channels - Yaw Axis - Faulted Component

Replace yaw computer No. 1 (Ref. 22-15-01). If problem persists, replace yaw computer No. 2 with previously removed yaw computer No. 1.

---

(12) Fault: DANA When AP B Set to CMD

(a) F/O Channel - Faulted Axis

Set AP B to OFF. On CB1, open A24. Install roll computer No. 2 T-cables. Close A24. Set AP B to CMD. Engage A/L. Wait until A/L track. Check for +28 VDC to ground at P1B-11 (yaw CAT III AVAIL). Is voltage present?

Yes: Pitch axis fault. Go to Step (b).

No: Yaw axis fault. Go to Step (c).

(b) F/O Channel - Pitch Axis - Faulted Components

Set AP B to OFF. On CB1, open A24. Remove roll computer No. 2 T-cables and install behind pitch computer No. 2. Close A24. Set AP B to CMD. Engage A/L. Wait until A/L track. Check for +28 VDC to ground at P2A-18 (HIGH AUTH HOOK MON). Is voltage present?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace pitch computer No. 1 with original pitch computer No. 2.

No: Problem in HIGH AUTH HOOK MON circuit (Ref. 22-11-00, SCHEM 9).

R

(c) F/O Channel - Yaw Axis - Faulted Component

Set AP B to OFF. On CB1, open A23. Install yaw computer No. 2 T-cables. Close A23 and wait one minute. Cycle YAW SAS. Set AP B to CMD. Engage

A/L. Wait until A/L Track. Check for +28VDC to ground at P2A-35 (RUDDER HOOK MONITOR). Is voltage present?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01). If problem persists, replace yaw computer No. 1 with previously removed yaw computer No. 2.

No: Problem in RUDDER HOOK MONITOR circuit (Ref. 22-15-00, SCHEM 5).

---

(13) Fault: DANA Annunciated with LOC deviation

(a) Faulted Channel

Set AP B to OFF. On CB1, open A6. Is DANA annunciation extinguished?

Yes: Fault affects Capt channel. Go to Step (c).

No: Fault affects F/O or both channels. Go to next step.

(b) On CB1, open A24. Close A6 and A24. Cycle yaw SAS. Set AP B to CMD. Engage A/L. Wait until A/L Track. Vary LOC beam deviation until DANA is annunciated and then set deviation to zero. Set AP B to OFF. Open A24. Is DANA annunciation extinguished?

Yes: Fault affects F/O channel. Go to Step (e).

No: Fault affects both channels. Go to Step (g).

(c) Capt Channel - Faulted Axis and Component

On CB1, open A24. Install roll computer No. 1 T-cables. Close A6 and A24. Set AP B to CMD. Engage A/L. Wait until A/L Track. Vary LOC until DANA is annunciated. Check LOC HI LEVEL DEV, and PROC ROLLOUT CMD voltages indicated in Column II of Figure 506. Are A and B SIGNALS from each source approximately the same?

Yes: Go to Step (d)

No: Replace component which provides signals.

(d) Check for +28VDC to ground at P1B-11 (YAW CAT III AVAIL) while performing LOC sweep test. Is voltage present continuously?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Replace yaw computer No. 1 (Ref. 22-15-01).

(e) F/O Channel - Faulted Axis and Component

On CB1, open A6. Install roll computer No. 2 T-cables. Close A6 and A24. Set AP B to CMD. Engage A/L. Wait until A/L Track. Vary LOC until DANA is annunciated. Check LOC HI LEVEL DEV, and PROC ROLLOUT CMD voltages indicated in Column II of Figure 506. Are A and B SIGNALS from each source approximately the same?

R

Yes: Go to Step (f).

No: Replace component which provides signals.

(f) Check for +28VDC to ground at P1B-11 (YAW CAT III AVAIL) while performing LOC sweep test. Is voltage present continuously?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace yaw computer No. 2 (Ref. 22-15-01).

(g) Both Channels - Faulted Axis and Component

On CB1, open A6. Remove roll computers No. 1 and No. 2. Adjust LOC-beam deviation for one-dot steer-right signal. Measure and note LOC beam deviation DC analog voltage between roll computer No. 1 rack connector P1A-18 and P1A-30. Measure equivalent voltage between roll computer No. 2 rack connector P1A-18 and P1A-30. Are voltages approximately equal?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 with previously removed roll computer No. 1, then replace yaw computer No.

1 and then replace yaw computer No. 2 with previously removed yaw computer No. 1.

No: Fault isolate ILS system (Ref. 34-33-00).

---

(14) Fault: DANA Annunciated during GS Deviation (A/L Track)

(a) Both Channels - Pitch Axis - Faulted Component

On CB1, open A6 and A24. Remove pitch computers No. 1 and No. 2. Adjust GS-beam deviation for one-dot steer-up signal. Check GS HI LEVEL DEV voltages listed in Column I of Figure 505 at pitch computer No. 1 and No. 2 rack connectors. Are all voltages equal?

R Yes: Go to Step (b).

No: Fault isolate ILS system (Ref. 34-33-00).

R (b) Check RADIO ALTITUDE voltages listed in Column II of Figure 505 at pitch computer No. 1 and No. 2 rack connectors. Are all voltages equal?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2 with previously removed pitch computer No. 1.

No: Fault isolate radio altimeter system (Ref. 34-32-00).

---

(15) Fault: DANA Annunciation at Align

(a) Faulted Channel

Set AP B to OFF. On CB1, open A6. Is DANA annunciation extinguished?

Yes: Fault affects Capt channel. Go to Step (b).

No: Fault affects F/O channel. Go to Step (c).

(b) Capt Channel - Faulted Axis and Component

On CB1, open A5. Install yaw computer No. 1 T-cables. Close A5 and wait one minute. Cycle YAW SAS. Close A6. Set AP B to CMD. Engage A/L. Wait until A/L Track (and ALIGN annunciation). Check for +28VDC to ground at P2A-51 (PROC NAV RCVR VALID). Is voltage present?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Replace roll computer No. 1 (Ref. 22-13-01).

(c) F/O Channel - Faulted Axis and Component

On CB1, open A23 and A24. Install yaw computer No. 2 T-cables. Close A23 and wait one minute. Cycle YAW SAS. Close A6 and A24. Set AP B to CMD. Engage A/L. Wait until A/L Track (and ALIGN annunciation). Check for +28VDC to ground at P2A-51 (PROC NAV RCVR VALID). Is voltage present?

Yes: Replace yaw computer (Ref. 22-15-01).

No: Replace roll computer (Ref. 22-13-01).

---

(16) Fault: DANA Annunciation during LOC Deviation in ALIGN Mode

(a) Faulted Channel

Set AP B to OFF. On CB1, open A6. Is DANA annunciation extinguished?

R Yes: Fault affects Capt channel. Go to Step
R (c).

No: Fault affects F/O or both channels. Go
R to Step (b).

R (b) On CB1, open A24. Close A6 and A24. Set AP B to CMD. Engage A/L. Wait until A/L Track (and ALIGN). Vary LOC beam deviation as follows until DANA is annunciated. Slowly vary LOC beam deviation to produce a one-bar width steer right indication on Capt HSI in approximately 5 seconds. Wait 5 seconds. Slowly vary LOC beam deviation to produce a zero indication on Capt HSI. Wait 5 seconds and repeat for left steer indication. Set

AP B to OFF. On CB1, open A24. Is DANA extinguished?

R Yes: Fault affects F/O channel. Go to Step
R (d).

R No: Fault affects both channels. Go to Step
R (e).

R (c) Capt Channel - Faulted Axis and Component

On CB1, open A24. Install roll computer No. 1 T-cables. Close A6 and A24. Set AP B to CMD. Engage A/L. Wait until A/L Track (and ALIGN). Establish one-bar width LOC-beam deviation in the direction in which DANA was annunciated. Check LOC HI LEVEL DEV, and PROC ROLLOUT CMD voltages indicated in Column II of Figure 506. Are A and B SIGNALS from each source approximately the same?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace yaw computer No. 1 (Ref. 22-15-01).

R No: Replace component which provides
R incorrect signals.

R (d) F/O Channel - Faulted Axis and Component

On CB1, open A6. Install roll computer No. 2 T-cables. Close A6 and A24. Set AP B to CMD. Engage A/L. Wait until A/L track (and ALIGN). Establish one-bar width LOC-beam deviation in the direction in which DANA was annunciated. Check LOC HI LEVEL DEV, and PROC ROLLOUT CMD voltages indicated in Column II of Figure 506. Are A and B SIGNALS from each source approximately the same?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace yaw
R computer No. 2 (Ref. 22-15-01).

R No: Replace component which provides
R incorrect signals.

R (e) Both Channels - Faulted Axis and Component

On CB1, open A6. Remove roll computers No. 1 and No. 2. Adjust LOC-beam deviation for one-bar width in the direction in which DANA was annunciated. Measure and note LOC beam deviation DC analog voltage between roll computer No. 1 rack

connector P1A-18 and P1A-30. Measure equivalent voltage between roll computer No. 2 rack connector P1A-18 and P1A-30. Are voltages approximately equal?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 with previously removed roll computer No. 1, then replace yaw computer No. 1 (Ref. 22-15-01) and then replace yaw computer No. 2 with previously removed yaw computer No. 1.

R No: Replace component which provides
R incorrect signals.

---

(17) Fault: DANA Annunciated with Change in Radio Altitude

(a) Pitch Axis - Faulted Channel and Component

Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch computer No. 2 with previously removed pitch computer No. 1.

---

(18) Fault: DANA Annunciated with Normal Acceleration

(a) Pitch Axis - Faulted Channel and Component

On CB1, open A6. Install pitch computer No. 1 T-cables. Close A6. Remove normal accelerometer unit from mount and tilt approximately 90 degrees in nose-up direction. Check NORMAL ACCELERATION, and NORMAL ACCELERATION C voltages listed in Column II of Figure 505. Are voltages approximately the same?

Yes: Go to Step (b).

No: Replace normal accelerometer unit (Ref. 22-11-02).

(b) Interchange normal accelerometer 2 and 3 cables at unit. Check NORMAL ACCELERATION, and NORMAL ACCELERATION C voltages listed in Column II of Figure 505. Are voltages approximately the same?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace pitch

computer No. 2 with previously removed pitch computer No. 1.

No: Replace normal accelerometer unit (Ref. 22-11-02).

---

(19) Fault: DANA Annunciated with Lateral Acceleration

(a) Roll Axis - Faulted Channel and Component

On CB1, open A6. Install roll computer No. 1 T-cables. Close A6. Remove lateral accelerometer from mount and tilt approximately 90 degrees in right wing down direction. Check LATERAL ACCELERATION, and LATERAL ACCELERATION C voltages listed in Column II of Figure 506. Are voltages approximately the same?

Yes: Go to Step (b).

No: Replace lateral accelerometer unit (Ref. 22-13-02).

(b) Interchange lateral accelerometer 2 and 3 cables at unit. Check LATERAL ACCELERATION, and LATERAL ACCELERATION C voltages listed in Column II of Figure 506. Are voltages approximately the same?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 with previously removed roll computer No. 1.

No: Replace lateral accelerometer unit (Ref. 22-13-02).

SIGNAL	FROM*	TYPE	MEASURE BETWEEN		NOM. VOLTS	
			HI	LO	I	II
PITCH ATTITUDE X	VG	AC ANALOG	P1A-67	GND	10.2	
PITCH ATTITUDE Y	VG	AC ANALOG	P1A-66	GND	10.2	
PITCH ATTITUDE Z	VG	AC ANALOG	P1A-54	GND	GND	
PITCH ATTITUDE X	VG3	AC ANALOG	P1B-67	GND	10.2	
PITCH ATTITUDE Y	VG3	AC ANALOG	P1B-66	GND	10.2	
PITCH ATTITUDE Z	VG3	AC ANALOG	P1B-54	GND	GND	
GS HI LEVEL DEV A	ILS	DC ANALOG	P1A-22	P1A-34	**	0
GS HI LEVEL DEV B	ILS	DC ANALOG	P1B-22	P1B-34	**	0
RADIO ALTITUDE A	RA	DC ANALOG	P1A-21	P1A-33	**	**
RADIO ALTITUDE B	RA	DC ANALOG	P1B-21	P1B-33	**	**
NORMAL ACCELERATION	NA	DC ANALOG	P1A-20	P1A-32	0	2.5
NORMAL ACCELERATION C	NA3	DC ANALOG	P1B-20	P1B-32	0	2.5

NOTE

*IF NOT NUMBERED, COMPONENT IS ON SAME SIDE AS CHANNEL BEING TESTED.

**A AND B SIGNALS FROM THE SAME SOURCE SHOULD BE EQUAL.

BLANK MEANS NO MEASUREMENT.

RADIO ALT 0 FT = 0.3V 100 FT = 24V 500 FT = 10.8V 1300 FT = 19.75V 1700 FT = 22V
GS DEV 0 DEV = 0V 1 DOT = 1V

M1-0101-22-250

R Pitch Computer T-Cable Voltage Measurements
R Figure 505

R EFFECTIVITY: ALL
R
001B

SIGNAL		FROM*	TYPE	MEASURE BETWEEN HI	MEASURE BETWEEN LO	NOM. VOLTS I	NOM. VOLTS II
ROLL ATTITUDE	X	VG	AC ANALOG	P1A-54	GND	10.2	
ROLL ATTITUDE	Y	VG	AC ANALOG	P1A-66	GND	10.2	
ROLL ATTITUDE	Z	VG	AC ANALOG	P1A-67	GND	GND	
ROLL ATTITUDE	X	VG3	AC ANALOG	P1B-54	GND	10.2	
ROLL ATTITUDE	Y	VG3	AC ANALOG	P1B-66	GND	10.2	
ROLL ATTITUDE	Z	VG3	AC ANALOG	P1B-67	GND	GND	
AILERON POSITION	A	AL	AC ANALOG	P1A-53	P1A-65		**
AILERON POSITION	B	AL	AC ANALOG	P1B-53	P1B-65		**
LOCHI LEVEL DEV	A	ILS	DC ANALOG	P1A-18	P1A-30	0	**
LOCHI LEVEL DEV	B	ILS	DC ANALOG	P1B-18	P1B-30	0	**
LATERAL ACCELERATION		LA	DC ANALOG	P1A-19	P1A-31	0	2.5
LATERAL ACCELERATION	C	LA3	DC ANALOG	P1B-19	P1B-31	0	2.5
AILERON CROSSFEED	A	YC	DC ANALOG	P1A-22	P1A-34	0	
AILERON CROSSFEED	B	YC	DC ANALOG	P1B-22	P1B-34	0	
RADIO ALTITUDE	A	RA	DC ANALOG	P1A-21	P1A-33	**	
RADIO ALTITUDE	B	RA	DC ANALOG	P1B-21	P1B-33	**	
PROC ROLLOUT CMD	A	RC	DC ANALOG	P1A-43	P1A-55		**
PROC ROLLOUT CMD	B	RC	DC ANALOG	P1B-43	P1B-55		**
LAT ACCEL MONITOR		LA	DC DISCRETE	P2B-27	GND	28	
YC AC PWR MONITOR	A	YC	DC DISCRETE	P2A-10	GND	28	

NOTES

*IF NOT NUMBERED, COMPONENT IS ON SAME SIDE AS CHANNEL BEING TESTED.

**A AND B SIGNALS FROM THE SAME SOURCE SHOULD BE EQUAL.

BLANK MEANS NO MEASUREMENT.

RADIO ALT 0 FT = 0.3V 100 FT = 2.4V 500 FT = 10.8V 1300 FT = 19.75V 1700 FT = 22V
LOC DEV 0 DEV = 0V 1 DOT = 1V

M1-0101-22-251

R Roll Computer T-Cable Voltage Measurements
R Figure 506

R EFFECTIVITY: ALL

R

001B

SIGNAL	FROM*	TYPE	MEASURE BETWEEN		NOM. VOLTS	
			HI	LO	I	II
YAW RATE	YAW RATE GYRO	AC ANALOG	P1A-14	P1A-24	0	
YAW RATE	YAW RATE GYRO-3	AC ANALOG	P1B-14	P1B-24	0	
YAW RATE SENSOR VALID	YAW RATE GYRO	DC DISCRETE	P2A-01	GND	12	
YAW RATE SENSOR VALID	YAW RATE GYRO-3	DC DISCRETE	P2B-01	GND	12	
OTHER RATE SENSOR VALID	OTHER YAW RATE GYRO	DC DISCRETE	P1A-48	GND	12	
OTHER ALIGN ENABLE	OTHER YAW COMPUTER	DC DISCRETE	P2A-17	GND	0	
ALIGN ENABLE	YAW COMPUTER	DC DISCRETE	P2B-17	GND	0	
AILERON POSITION A	DUAL A/L POS XMTR	AC ANALOG	P1A-18	P1A-28		**
AILERON POSITION B	DUAL A/L POS XMTR	AC ANALOG	P1B-18	P1B-28		**

NOTE

* IF NOT NUMBERED, COMPONENT IS ON SAME SIDE AS CHANNEL BEING TESTED, EXCEPT FOR SIGNALS INDICATED AS "OTHER".

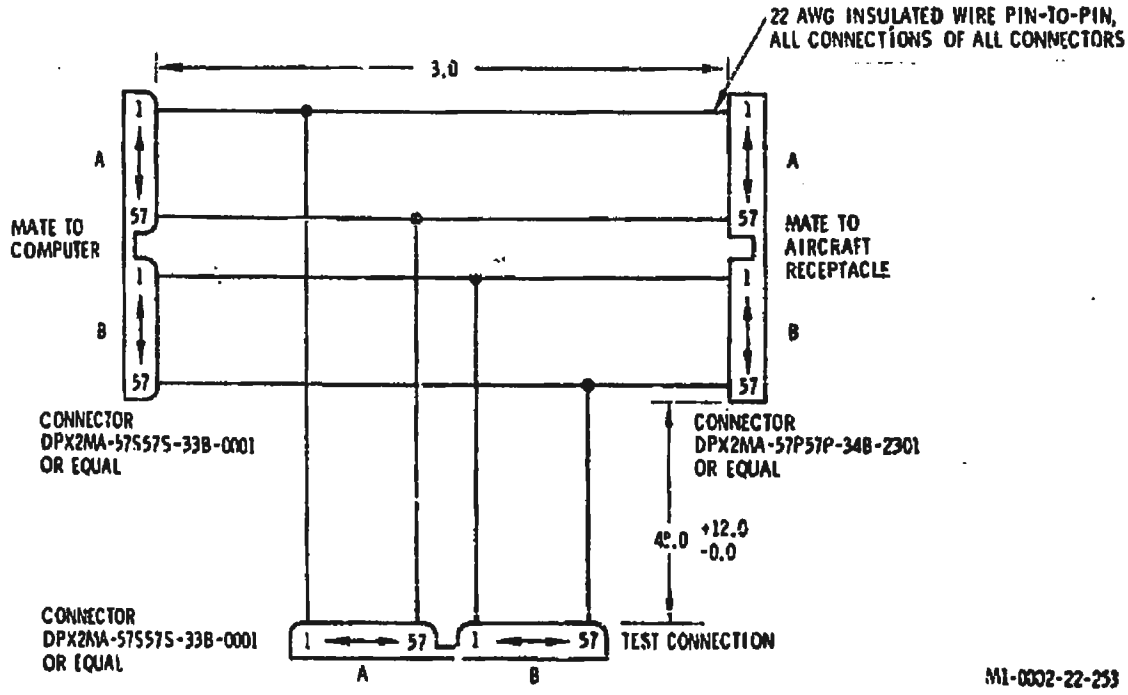
**A AND B SIGNALS FROM SAME SOURCE SHOULD BE EQUAL.

BLANK MEANS NO MEASUREMENT.

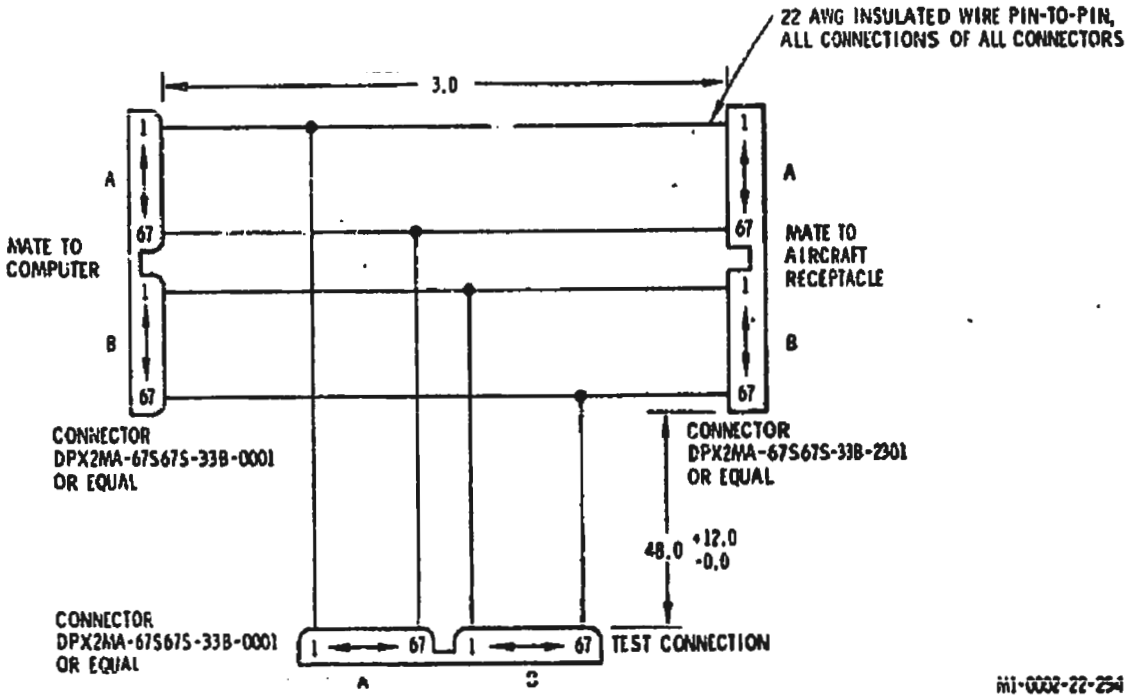
M1-0100-22-252

R Yaw Computer T-Cable Voltage Measurements
R Figure 507

R EFFECTIVITY: ALL
R
001B



R Breakout Cable Assembly for Yaw Computers
R Figure 508



R Breakout Cable Assembly for Pitch and Roll Computers
R Figure 509

R

GO AROUND MODE - FAULT ISOLATION

R 1. General

R The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for appropriate fault isolation.

R Figure 101 and 102 provide component location for Go Around Mode troubleshooting.

R 2. Equipment and Materials

R None

R 3. Referenced Procedures

R	22-12-00	APFDS Modes of Operation - Maintenance Practice
R	22-15-00	YAW SAS System - Fault Isolation
R	22-17-00	Flight Control Electronics System - Fault Isolation
R	22-18-00	Trim Augmentation System - Fault Isolation
R	22-31-00	Speed Control System - Fault Isolation

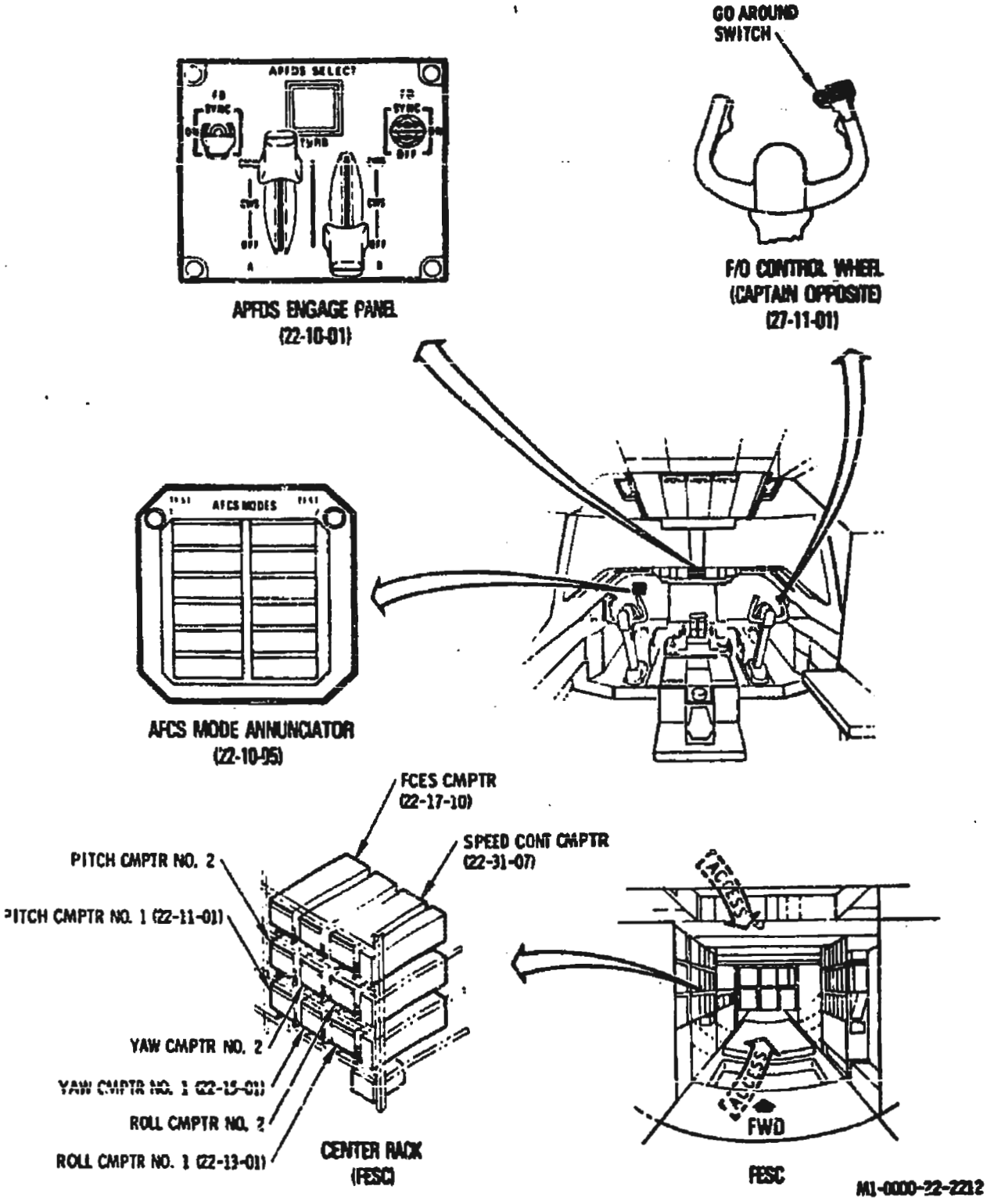
COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – FLIGHT CONTROL ELECTRONICS SYSTEM	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – SPEED CONTROL	1	FESC, CTR RACK/112AB	22-31-07
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05
PANEL – APFOS ENGAGE	1	FLT STA, GLRSHLD PNL	22-10-01
SWITCH – GO AROUND	2	FLT STA, CONTROL WHEEL	22-10-22
WHEEL – CONTROL	2	FLT STA	27-11-01

M1-0000-22-2211

R R Component Location Index
Figure 101

EFFECTIVITY: ALL

001B



R
R

Component Locator Diagram
Figure 102

EFFECTIVITY: ALL

0018

R 4. Fault_Detection_Test

R A. Preliminary Procedures

R (1) Perform flight director and autopilot setup procedures,
R Paragraphs 4A and 4B respectively of 22-12-00
R Maintenance Practices.

R NOTE: Before applying hydraulic power, ensure that the
R DLC/AUTO SPLR 1 and 2 switchlights (on FCES
R panel) are in the OFF (un-detented) position.

R (2) On both VHF NAV panel frequency selectors, select local
R VOR frequency.

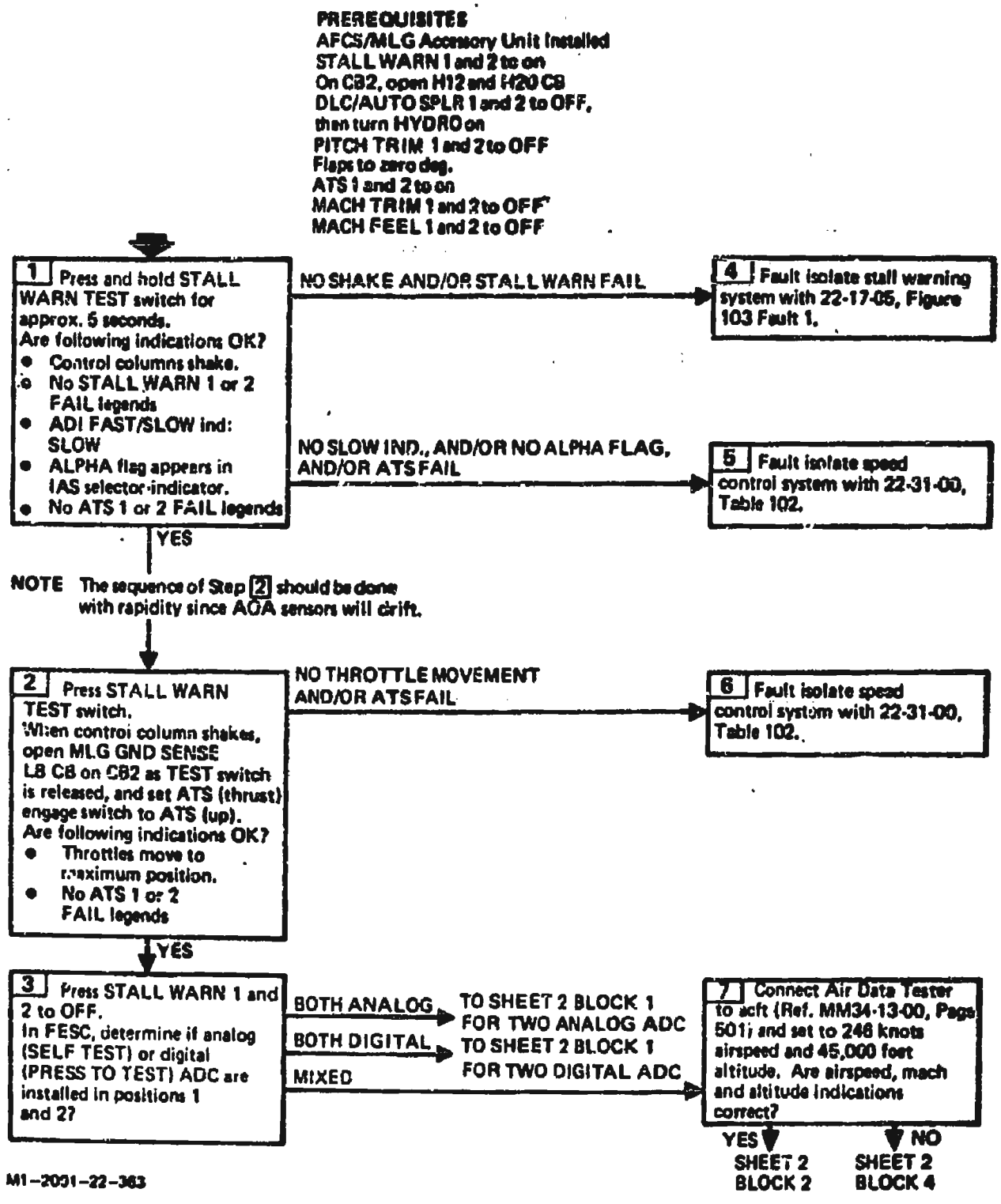
R (3) On FCES panel:

R (a) Cycle PITCH TRIM 1 and 2 switchlights OFF and then
R on. If PITCH TRIM switchlights indicate FAIL,
R fault isolate pitch trim system (Ref. 22-18-00,
R Table 102).

R (b) Cycle YAW SAS 1 and 2 switchlights OFF and then
R on. If YAW SAS switchlights indicate FAIL, fault
R isolate YAW SAS system (Ref. 22-15-00, 101).

R (4) Perform speed control system check as detailed in
R Figure 103.

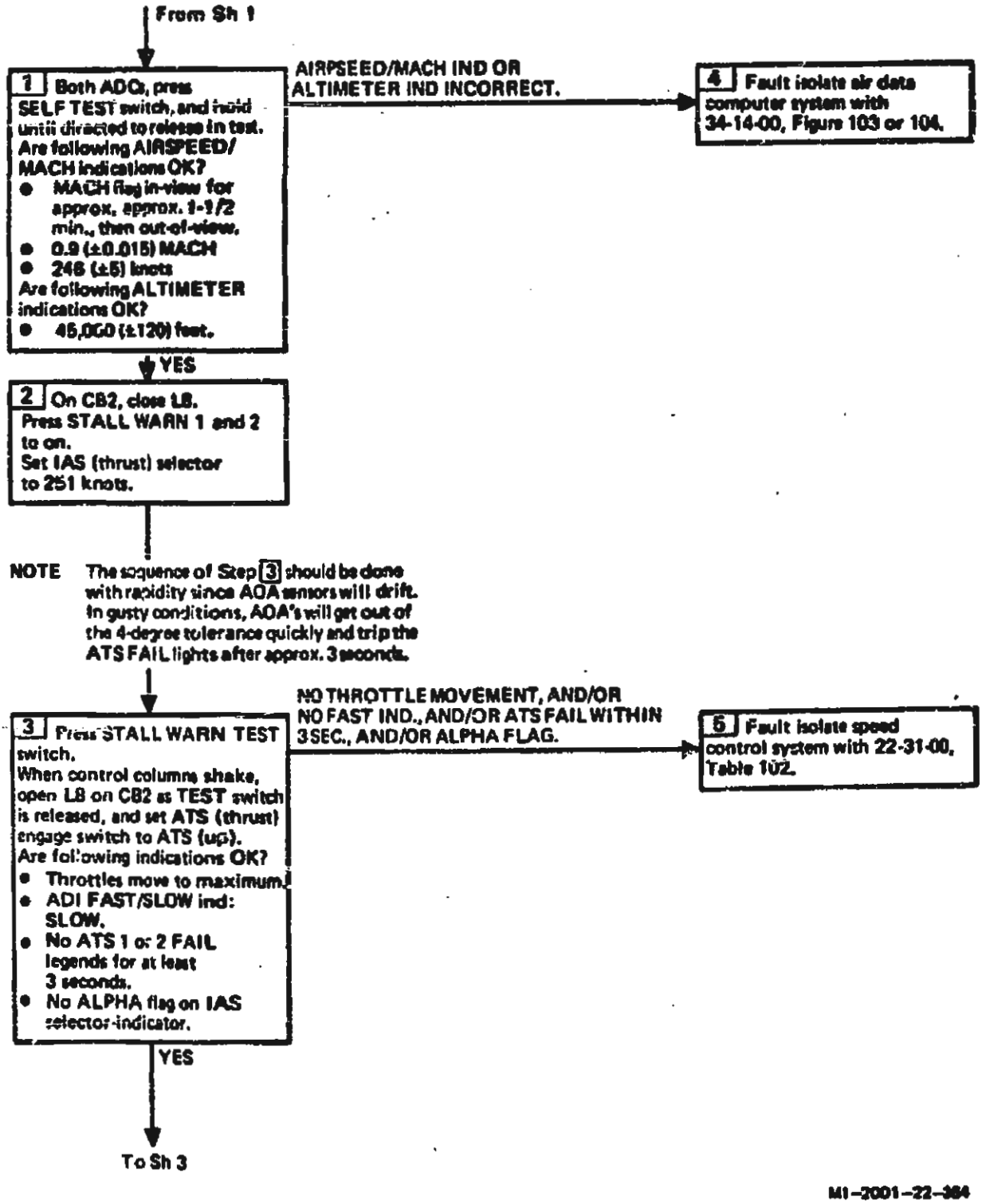
R Do not progress further into this test unless the SCS
R passes the requirements of the speed control system
R check.


PREREQUISITES
AFCS/MLG Accessory Unit Installed
STALL WARN 1 and 2 to on
On CB2, open H12 and H20 CB
DLC/AUTO SPLR 1 and 2 to OFF,
then turn HYDRO on
PITCH TRIM 1 and 2 to OFF
Flaps to zero deg.
ATS 1 and 2 to on
MACH TRIM 1 and 2 to OFF
MACH FEEL 1 and 2 to OFF
1 Press and hold STALL WARN TEST switch for approx. 5 seconds.
Are following indications OK?
• Control columns shake.
• No STALL WARN 1 or 2 FAIL legends
• ADI FAST/SLOW ind: SLOW
• ALPHA flag appears in IAS selector-indicator.
• No ATS 1 or 2 FAIL legends
NO SHAKE AND/OR STALL WARN FAIL
4 Fault isolate stall warning system with 22-17-05, Figure 103 Fault 1.
NO SLOW IND., AND/OR NO ALPHA FLAG, AND/OR ATS FAIL
5 Fault isolate speed control system with 22-31-00, Table 102.
YES
NOTE The sequence of Step 2 should be done with rapidity since AOA sensors will drift.
2 Press STALL WARN TEST switch.
When control column shakes, open MLG GND SENSE LB CB on CB2 as TEST switch is released, and set ATS (thrust) engage switch to ATS (up).
Are following indications OK?
• Throttles move to maximum position.
• No ATS 1 or 2 FAIL legends
NO THROTTLE MOVEMENT AND/OR ATS FAIL
6 Fault isolate speed control system with 22-31-00, Table 102.
YES
3 Press STALL WARN 1 and 2 to OFF.
In FESC, determine if analog (SELF TEST) or digital (PRESS TO TEST) ADC are installed in positions 1 and 2?
BOTH ANALOG
TO SHEET 2 BLOCK 1 FOR TWO ANALOG ADC
BOTH DIGITAL
TO SHEET 2 BLOCK 1 FOR TWO DIGITAL ADC
MIXED
7 Connect Air Data Tester to acft (Ref. MM34-13-00, Page 501) and set to 246 knots airspeed and 45,000 feet altitude. Are airspeed, mach and altitude indications correct?
YES
SHEET 2 BLOCK 2
NO
SHEET 2 BLOCK 4
M1-2001-22-363

R R Speed Control System Fault Problem
Figure 103 (Sheet 1)

EFFECTIVITY: ALL

001B

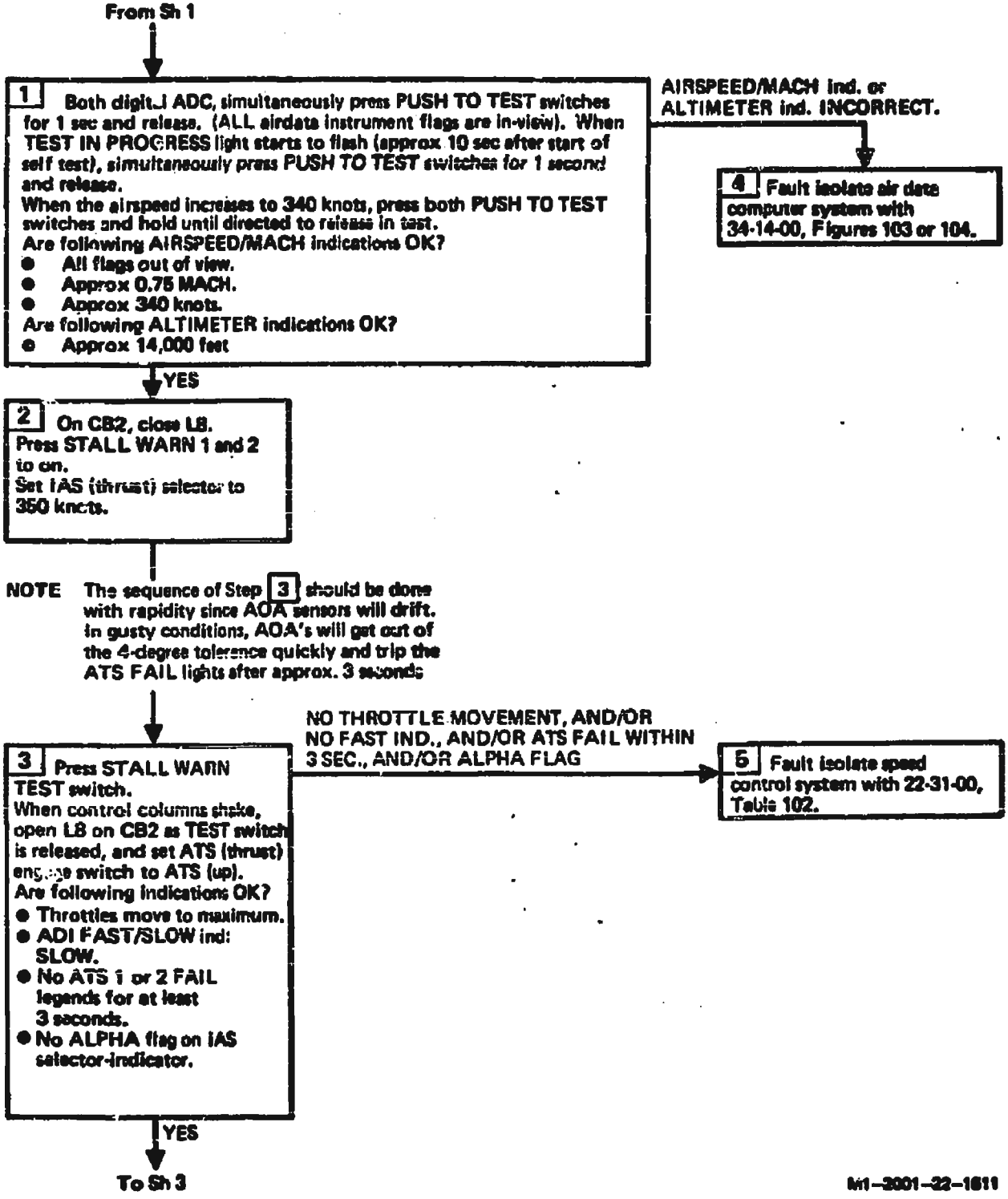

From Sh 1
1 Both ADCs, press SELF TEST switch, and hold until directed to release in test. Are following AIRSPEED/ MACH indications OK?
• MACH flag in-view for approx. approx. 1-1/2 min., then out-of-view.
• 0.9 (±0.015) MACH
• 248 (±5) knots
Are following ALTIMETER indications OK?
• 45,000 (±120) feet.
AIRPSEED/MACH IND OR ALTIMETER IND INCORRECT.
4 Fault isolate air data computer system with 34-14-00, Figure 103 or 104.
YES
2 On CB2, close L8. Press STALL WARN 1 and 2 to on. Set IAS (thrust) selector to 251 knots.
NOTE The sequence of Step 3 should be done with rapidity since AOA sensors will drift. In gusty conditions, AOA's will get out of the 4-degree tolerance quickly and trip the ATS FAIL lights after approx. 3 seconds.
3 Press STALL WARN TEST switch. When control column shake, open L8 on CB2 as TEST switch is released, and set ATS (thrust) engage switch to ATS (up). Are following indications OK?
• Throttles move to maximum.
• ADI FAST/SLOW ind: SLOW.
• No ATS 1 or 2 FAIL legends for at least 3 seconds.
• No ALPHA flag on IAS selector-indicator.
NO THROTTLE MOVEMENT, AND/OR NO FAST IND., AND/OR ATS FAIL WITHIN 3 SEC., AND/OR ALPHA FLAG.
5 Fault isolate speed control system with 22-31-00, Table 102.
YES
To Sh 3

M1-2001-22-384

R Speed Control System Fault Problem
R Figure 103 (Sheet 2)

EFFECTIVITY: WITH TWO ANALOG ADC

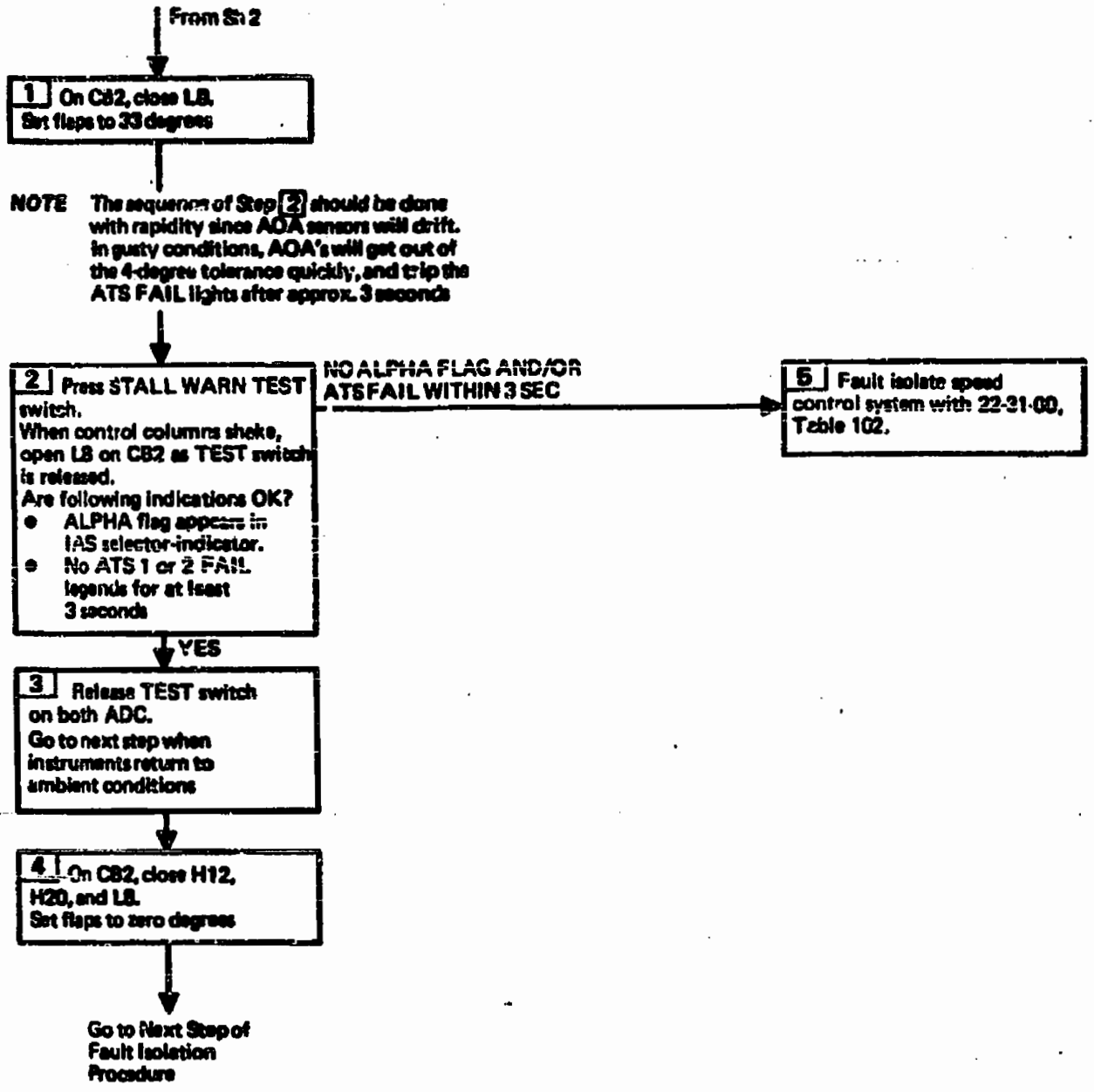
0018


From Sh 1
1 Both digital ADC, simultaneously press PUSH TO TEST switches for 1 sec and release. (ALL airdata instrument flags are in-view). When TEST IN PROGRESS light starts to flash (approx 10 sec after start of self test), simultaneously press PUSH TO TEST switches for 1 second and release.
When the airspeed increases to 340 knots, press both PUSH TO TEST switches and hold until directed to release in test.
Are following AIRSPEED/MACH indications OK?
● All flags out of view.
● Approx 0.75 MACH.
● Approx 340 knots.
Are following ALTIMETER indications OK?
● Approx 14,000 feet
AIRSPEED/MACH ind. or ALTIMETER ind. INCORRECT.
4 Fault isolate air data computer system with 34-14-00, Figures 103 or 104.
YES
2 On CB2, close L8.
Press STALL WARN 1 and 2 to on.
Set IAS (thrust) selector to 350 knots.
NOTE The sequence of Step 3 should be done with rapidity since AOA sensors will drift. In gusty conditions, AOA's will get out of the 4-degree tolerence quickly and trip the ATS FAIL lights after approx. 3 seconds
3 Press STALL WARN TEST switch.
When control columns shake, open L8 on CB2 as TEST switch is released, and set ATS (thrust) engage switch to ATS (up).
Are following indications OK?
● Throttles move to maximum.
● ADI FAST/SLOW ind: SLOW.
● No ATS 1 or 2 FAIL legends for at least 3 seconds.
● No ALPHA flag on IAS selector-indicator.
NO THROTTLE MOVEMENT, AND/OR NO FAST IND., AND/OR ATS FAIL WITHIN 3 SEC., AND/OR ALPHA FLAG
5 Fault isolate speed control system with 22-31-00, Table 102.
YES
To Sh 3
M1-2001-22-1611

R Speed Control System Fault Problem
R Figure 103 (Sheet 2)

EFFECTIVITY: WITH TWO DIGITAL ADC

001B


From St 2
1 On CB2, close LB.
Set flaps to 33 degrees
NOTE The sequence of Step 2 should be done with rapidity since AOA sensors will drift. In gusty conditions, AOA's will get out of the 4-degree tolerance quickly, and trip the ATS FAIL lights after approx. 3 seconds
2 Press STALL WARN TEST switch.
When control columns shake, open LB on CB2 as TEST switch is released.
Are following indications OK?
• ALPHA flag appears in IAS selector-indicator.
• No ATS 1 or 2 FAIL legends for at least 3 seconds
NO ALPHA FLAG AND/OR ATS FAIL WITHIN 3 SEC
5 Fault isolate speed control system with 22-31-00, Table 102.
YES
3 Release TEST switch on both ADC.
Go to next step when instruments return to ambient conditions
4 On CB2, close H12, H20, and LB.
Set flaps to zero degrees
Go to Next Step of Fault Isolation Procedure

M1-2001-22-388

R Speed Control System Fault Problem
R Figure 103 (Sheet 3)

(5) Before proceeding ensure that;

(a) AFCS/MLG accessory unit is installed.

(b) Flaps are retracted.

(c) Slats are not locked.

(d) On FCES panel, STALL WARN 1 and 2 switchlights are on.

(e) On APFDS ENGAGE panel, set FD switches A and B to ON. On both ADI's, command bars should be centered and level. If not fault isolate FD basic mode (Ref. 22-10-31, 103). Set FD A and B switches TO OFF.

(f) On APFDS ENGAGE panel, set AP engage switch A to CMD. If unable to set to, or hold in CMD, fault isolate autopilot A CWS/CMD mode (Ref. 22-10-33, 103). Disengage autopilot A.

(g) On APFDS ENGAGE panel, set AP engage switch B to CMD. If unable to set to, or hold in CMD, fault isolate autopilot B CWS/CMD mode (Ref. 22-10-35, 103). Disengage autopilot B.

(h) On pilots overhead COMPASS panels, manually slew both compass systems to a heading approximately 10 degrees more than aircraft heading and then release slew switches.

NOTE: During slewing process ignore HSI HDG flags.

(i) On APFDS ENGAGE panel, set FD A and B switches to ON. On both ADI's command bars gradually command right roll as both compasses automatically slew back to aircraft heading. Wait until a right roll command is clearly discernable from a wings level command.

NOTE: If a right roll command is not obtained within five (5) minutes, fault isolate flight director heading mode (Ref. 22-10-31, 103).

B. Go Around Mode Test

(1) Remove AFCS/MLG accessory unit.

(2) On Capt control wheel, momentarily depress GO AROUND switch.

RESULT:

R R R On both AFCS MODES annunciators, GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178), message is displayed.

On both ADI's, command bars command wings level.

NOTE: Pitch command bar positioning is related to angle-of-attack probe positioning and usually commands more down. (4) On FCES panel, depress STALL WARN TEST and hold (for approximately 30 secs.).

RESULT:

On both ADI's, command bars command nose-down.

(5) On APFDS ENGAGE panel, set FD A and B switches to OFF.

RESULT:

R R R On both AFCS MODES annunciators, GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178), messages are removed. On both ADI's, command bars are removed from view.

(6) Remove AFCS/MLG accessory unit.

(7) On APFDS ENGAGE panel, set FD A and B switches to ON.

(8) On F/O control wheel, momentarily depress GO AROUND switch.

RESULT:

R R R On both AFCS MODES annunciators, GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178), message is displayed.

(9) On APFDS ENGAGE panel, set FD A and B switches to OFF.

RESULT:

R R R On both AFCS MODES annunciators, GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178), messages are removed. On both ADI's, command bars are removed from view.

(10) Extend flaps to 33 degrees or greater.

(11) On APFDS ENGAGE panel, set FD A and B switches to ON and set AP engage switch A to CMD.

RESULT:

Autopilot engage switch A will set to, and remain, in CMD.

(12) On Capt control column, slowly push forward with increasing force until AP LIMIT warning message is displayed. Note the force required to bring the AP LIMIT warning message in view.

NOTE: Force should be applied to the control column, rather than control wheel. The force required to bring the AP LIMIT warning message in view is defined as the authority level.

(13) Using the rudder pedals, note the force required to displace the rudder.

(14) On Capt control wheel, momentarily depress GO AROUND switch.

RESULT:

R On both AFCS MODES annunciators, GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft
R with SB34-178), message is displayed. AP engage switch A remains in CMD.

(15) On Capt control column, slowly push forward with increasing force until AP LIMIT warning message is displayed, and note force required.

RESULT:

Force required to overpower autopilot A in pitch, during GO AROUND is noticeably higher than during cruise modes.

(16) Using the rudder pedals, note the force required to displace the rudder.

RESULT:

Force required to overpower YAW SAS No. 1 during GO AROUND is noticeably higher than during cruise modes.

(17) On APFDS ENGAGE panel, set FD A and B switches to OFF. Set AP engage switch A to OFF.

(18) On APFDS ENGAGE panel, set FD A and B switches to ON. Set AP engage switch B to CMD.

RESULT:

AP engage switch B will set to, and remain in, CMD.

(19) On Capt control column, slowly push forward with increasing force until AP LIMIT warning message is displayed. Note the force required to bring the AP LIMIT warning message in view.

(20) Using the rudder pedals, note the force required to displace the rudder.

(21) On Capt control wheel, momentarily depress GO AROUND switch.

RESULT:

R On both AFCS MODES annunciators, GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft
R with SB34-178), message is displayed. AP engage switch B remains in CMD.

(22) On Capt control column, slowly push forward with increasing force until AP LIMIT warning message is displayed, and note force required.

RESULT:

Force required to overpower autopilot B in pitch during GO AROUND is noticeably higher than during cruise modes.

(23) Using the rudder pedals, note the force required to displace the rudder.

RESULT:

Force required to overpower the YAW SAS No. 2 during GO AROUND is noticeably higher than during cruise modes.

(24) On APFDS ENGAGE panel, set FD A and B switches to OFF. Set AP engage switch B to OFF.

(25) On APFDS ENGAGE panel, set FD A and B switches to ON. Set AP engage switch A to CMD.

(26) On F/O control wheel, momentarily depress GO AROUND switch.

RESULT:

R On both AFCS MODES annunciators, GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft
R with SB34-178), message is displayed. AP engage switch A remains in CMD.

(27) On APFDS ENGAGE panel, set FD A and B switches to OFF. Set AP engage switch A to OFF.

(28) On APFDS ENGAGE panel, set FD A and B switches to ON. Set AP engage switch B to CMD.

(29) On FCES panel, depress STALL WARN switchlights 1 and 2 to OFF, and depress DLC/AUTO SPLR switchlights 1 and 2 to on (detented).

RESULT:

Speedbrake lever deploys to DLC NEUTRAL.

NOTE: DLC NEUTRAL is defined as the aft edge of the speedbrake lever in approximately center of DLC RANGE marking.

DLC/AUTO SPLR switchlights 1 and 2 do not indicate FAIL.

(30) On F/O control wheel, momentarily depress GO AROUND switch.

RESULT:

R On both AFCS MODES annunciators, GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft
R with SB34-178), message is displayed. AP engage switch B remains in CMD.

Speedbrake lever stows.

DLC/AUTO SPLR switchlights do not indicate FAIL.

(31) On FCES panel, depress DLC/AUTO SPLR switchlights 1 and 2 to OFF.

(32) On APFDS ENGAGE panel, set AP engage switch B to OFF, and set FD A and B switches to OFF.

(33) On either AFCS MODES annunciator, depress TEST 1 switch.

RESULT:

On either AFCS WARNING indicator, NO GA shall not be annunciated.

(34) Set flaps to 4 degrees.

(35) On APFDS ENGAGE panel, set FD A and B switches to ON.

RESULT:

On both ADI's, command bars come into view and are centered and level.

(36) On either control wheel, momentarily depress GO AROUND switch.

RESULT:

R On both AFCS MODES annunciators, GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft
R with SB34-178), message is displayed.

(37) Set flap handle to 0 degrees.

RESULT:

On both ADI's, FD flags, command bars, and FAST/SLOW indicators should not move in- and out-of-view.

(38) Set FD A and B to OFF.

(39) Reinstall AFCS/MLG accessory unit.

5. Fault Isolation

A. General

Table 101 is a summary of Faults encountered when performing the Fault Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 102. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

Go Around Mode Fault Isolation Summary
Table 101

	TEST REF.	FAULT	FAULT NO.
R R R	4B(2)-1	No GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178), message on Capt AFCS ann when Capt GO AROUND switch is depressed.	(1)
R R R	4B(2)-2	No GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178), message on F/O AFCS ann when Capt GO AROUND switch is depressed.	(2)
	4B(2)-3	On Capt ADI, command bar does not command wings level during GO ARND mode.	(3)
	4B(2)-4	On F/O ADI, command bar does not command wings level during GO ARND mode.	(4)
	4B(4)-1	On Capt ADI, command bar does not command nose-down during GO ARND mode with STALL WARN TEST.	(5)
	4B(4)-2	On F/O ADI, command bar does not command nose-down during GO ARND mode with STALL WARN TEST.	(6)
R R R	4B(8)-1	On Capt AFCS MODES ann, no GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178),message when F/O GO AROUND switch is depressed.	(7)

Go Around Mode Fault Isolation Summary (Cont)
Table 101

	TEST REF.	FAULT	FAULT NO.
R R R	4B(8)-2	On F/O AFCS MODES ann, no GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178), message when F/O GO AROUND switch is depressed.	(8)
	4B(14)	AP engage switch A will not remain in CMD when GO AROUND mode is set from Capt control wheel.	(9)
	4B(15)	Force required to overpower autopilot A in pitch during GO ARND mode is same as during cruise modes.	(10)
	4B(16)	Force required to overpower YAW SAS No. 1 during GO ARND mode is same as during cruise modes.	(11)
	4B(21)	AP engage switch B will not remain in CMD when GO ARND mode is set from Capt control wheel.	(12)
	4B(22)	Force required to overpower autopilot B in pitch during GO ARND mode is same as during cruise mode.	(13)
	4B(23)	Force required to overpower YAW SAS No. 2 during GO ARND mode is same as during cruise modes.	(14)
	4B(26)	AP engage switch will not remain in CMD when GO ARND mode is set from F/O control wheel.	(15)
	4B(30)-1	AP engage switch B will not remain in CMD when GO ARND mode is set from F/O control wheel.	(16)
	4B(30)-2	Speedbrake lever does not stow when GO ARND mode is engaged.	(17)
	4B(30)-3	DLC/AUTO SPLR switchlight FAIL when GO ARND mode is set.	(18)
	4B(33)	NO GA warning when AFCS MODES ind TEST 1 switch is depressed.	(19)

Go Around Mode Fault Isolation Summary (Cont)
Table 101

TEST REF.	FAULT	FAULT NO.
4B(37)	FD Flags, command bars, and FAST/SLOW indicators move in- and out-of-view, during go around mode, when flap handle is moved from 4-degree position to 0-degree position.	(20)

Schematics for Fault Isolation of Go Around Mode Problem
Table 102

TITLE	LOCATION
Pitch Systems No. 1 and No. 2 TO/GA and Basic Mode Signal Flow Schematic	22-11-00, Schem 4
Pitch System 1 CWS/CRUISE Mode Signal Flow Schematic	22-11-00, Schem 5
Pitch System 2 CWS/CRUISE Mode Signal Flow Schematic	22-11-00 Schem 6
Takeoff/Go-Around Modes Engage Logic Schematic	22-11-00, Schem 12
A/L, LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7
Roll Servo Engage/Valid and Roll Valid Logic Schematic	22-13-00, Schem 10
Takeoff/Go-Around Signal Flow Schematic	22-31-00, Schem 3
Takeoff/Go-Around Mode Switching Logic Schematic	22-31-00,Schem 5
Takeoff/Go-Around Valid and No Go-Around Annunciation Logic Schematic	22-31-00, SCHEM 8

B. Go-Around Mode Faults

R (1) Fault: On Capt AFCS MODES annunciator, no GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft with
R SB34-178), message when Capt GO AROUND switch is depressed.

R (a) Depress F/O GO AROUND switch. Does GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft
R with SB34-178), message appear?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Go to step (b).

(b) On Capt AFCS MODES annunciator, depress TEST 1
R switch. Does GO ARND (on aircraft without
R SB34-178), TO/GA (on aircraft with SB34-178), message appear?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace Capt AFCS MODES annunciator (Ref. 22-10-05).

R (2) Fault: On F/O AFCS MODES annunciator, no GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft with
R SB34-178), message when Capt GO AROUND switch is depressed.

R (a) Depress F/O GO AROUND switch. Does GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft
R with SB34-178), message appear?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Go to step (b).

(b) On F/O AFCS MODES annunciator, depress TEST 1
R switch. Does GO ARND (on aircraft without
R SB34-178), TO/GA (on aircraft with SB34-178), message appear?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace F/O AFCS MODES annunciator (Ref. 22-10-05).

(3) Fault: On Capt ADI, command bar does not command wings level during Go Around Mode.

(a) Is FD flag in view?

Yes: Go to step (b).

No: Replace roll computer No. 1 (Ref. 22-13-01). If failure persists, replace pitch computer No. 1 (Ref. 22-11-01).

(b) Is ADI FAST/SLOW indicator in view?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

(4) Fault: On F/O ADI, command bar does not command wings level during Go Around Mode.

(a) Is FD flag in view?

Yes: Go to step (b).

No: Replace roll computer No. 2 (Ref. 22-13-01). If failure persists, replace pitch computer No. 2 (Ref. 22-11-01).

(b) Is ADI FAST/SLOW indicator in view?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

(5) Fault: On Capt ADI, command bar does not command nose-down during Go Around mode with STALL WARN TEST.

On Capt ADI, does FAST/SLOW indicator display SLOW?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

(6) Fault: On F/O ADI, command bar does not command nose-down during Go Around mode with STALL WARN TEST.

On F/O ADI, does FAST/SLOW indicator display SLOW?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace speed control computer (Ref. 22-31-07).

R (7) Fault: On Capt AFCS MODES annunciator, no GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft with
R SB34-178),message when F/O GO AROUND switch is depressed.

Replace F/O control wheel (Ref. 27-11-01).

R (8) Fault: On F/O AFCS MODES annunciator, no GO ARND (on
R aircraft without SB34-178), TO/GA (on aircraft with
R SB34-178),message when F/O GO AROUND switch is depressed.

Replace F/O control wheel (Ref. 27-11-01).

(9) Fault: AP engage switch A will not remain in CMD when GO AROUND mode is set from Capt control wheel.

Set FD A and B switches and AP engage switch A to OFF. Set AP engage switch A to CMD. On F/O control wheel, momentarily depress GO AROUND switch. Does AP engage switch A remain in CMD?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Replace pitch computer No. 1 (Ref. 22-11-01). If failure persists, check 30-degree flap switch A (FS/A) and 30-degree flap switch B (FS/B) circuits (Ref. 22-11-00, SCHEM 12, Sheet 1) to pitch computer No. 1.

(10) Fault: Force required to overpower autopilot A in pitch during Go Around mode is same as during cruise modes.

Replace pitch computer No. 1 (Ref. 22-11-01). If failure persists, check autopilot A HIGH AUTH HOOK ENG SOL VALVE circuit (Ref. 22-11-00, SCHEM 9, Sheet 1).

---

(11) Fault: Force required to overpower YAW SAS No. 1 during GO ARND mode is same as during cruise modes. Replace Yaw computer No. 1 (Ref. 22-15-01). If failure persists, replace APFDS ENGAGE panel (Ref. 22-10-01). If failure persists, check RUDDER HOOK ENG A/P ENG SOL (HYD SYS B) circuit (Ref. 22-15-00, SCHEM 5, Sheet 2).

---

(12) Fault: AP engage switch B will not remain in CMD when GO AROUND mode is set from Capt control wheel.

Set FD A and B switches and AP engage switch B to OFF. Set AP engage switch B to CMD. On F/O control wheel, momentarily depress GO AROUND switch. Does AP engage switch B remain in CMD?

Yes: Replace Capt control wheel (Ref. 27-11-01).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If failure persists, check 30-degree flap switch A (FS/A) and 30-degree flap switch B (FS/B) circuits (Ref. 22-11-00, SCHEM 12, Sheet 1) to pitch computer No. 2.

---

(13) Fault: Force required to overpower autopilot B in pitch during Go Around is same as during cruise modes.

Replace pitch computer No. 2 (Ref. 22-11-01). If failure persists, check autopilot B HIGH AUTH HOOK ENG SOL VALVE circuit (Ref. 22-11-00, SCHEM 9, Sheet 1).

---

(14) Fault: Force required to overpower YAW SAS No. 2 during GO AROUND is same as during cruise modes. Replace Yaw computer No. 2 (Ref. 22-15-01). If failure persists, replace APFDS ENGAGE panel (Ref. 22-10-01). If failure persists, check RUDDER HOOK ENG A/P ENG SOL (HYD SYS A) circuit (Ref. 22-15-00, SCHEM 5, Sheet 2).

(15) Fault: AP engage switch A will not remain in CMD when GO AROUND mode is set from F/O control wheel. Replace F/O control wheel (Ref. 27-11-01).

(16) Fault: AP engage switch B will not remain in CMD when GO AROUND mode is set from F/O control wheel. Replace F/O control wheel (Ref. 27-11-01).

(17) Fault: Speedbrake lever does not stow when GO AROUND mode is engaged.

Replace FCES computer (Ref. 22-17-01).

(18) Fault: DLC/AUTO SPLR switchlights indicate FAIL when GO AROUND mode is set.

Replace FCES computer (Ref. 22-17-01). If failure persists, check Go Around Engaged (GAE/1A, GAE/113, GAE/2A, and GAE/2B) circuits to FCES computer (Ref. 22-11-00, SCHEM 12, Sheet 2).

(19) Fault: NO GA warning is annunciated when AFCS MODES indicator TEST 1 switch is depressed.

Replace speed control computer (Ref. 22-31-07).

(20) Fault: FD flags, command bars, and FAST/SLOW indicators move in- and out-of-view, during go around mode, when flap handle is moved from 4-degree position to 0-degree position.

(a) Time flap movement from 4 degrees to 0 degrees (6 - 8 seconds is normal). Is time greater than 8 seconds?

Yes: Check Vane Lubrication (Ref. 12-23-20, Figure 302), check Wing Flap Lubrication (Ref. 12-23-20, Figure 303), and check Wing Flap Power Drive Unit Lubrication (Ref. 12-23-20, Figure

304). If fault persists, fault isolate flap system for slow movement (Ref. 27-51-00).

No: Replace speed control computer (Ref. 22-31-07).

AUTOPILOT - FLIGHT DIRECTOR ROLL SYSTEM - DESCRIPTION AND OPERATION

1. General

The autopilot flight director (APFD) roll system provides single-channel fail-soft cruise modes, and dual-dual channel
R fail-operational AUTOLAND track roll axis commands for the AFCS. The APFD roll system provides roll servo drive and flight director drive as basic outputs.

The APFD roll system is comprised of the following components (Ref. Fig. 1):

22-10-01 APFDS ENGAGE Panel

22-10-02 NAV MODE Panel

22-10-03 HDG/PITCH MODE Panel

22-10-05 AFCS MODES Annunciator

22-10-06 AFCS WARNING Indicator

22-10-11 AFCS/MLG Accessory Unit

22-13-01 Roll Computer

22-13-02 Lateral Accelerometer Unit

22-13-03 Left Aileron Dual Position Transducer

In addition to the APFD roll system components, the system uses inputs from other aircraft systems (Ref. Fig. 2). Paragraph 12 lists the APFD roll system interface with other systems.

2. Operation

A. Power Application

Power application to the APFD roll system is described in Section 22-12-00.

B. Common Modes of Operation

Roll modes of operation that are common with pitch modes of operation are described in Section 22-12-00.

C. Roll Axis Modes of Operation

The roll axis operating modes are engaged automatically through APFDS engagement or by manual selection on the flight station glareshield control panels. The following roll axis modes are available:

Wings level

Heading hold or Bank hold

Control wheel steering

Heading select

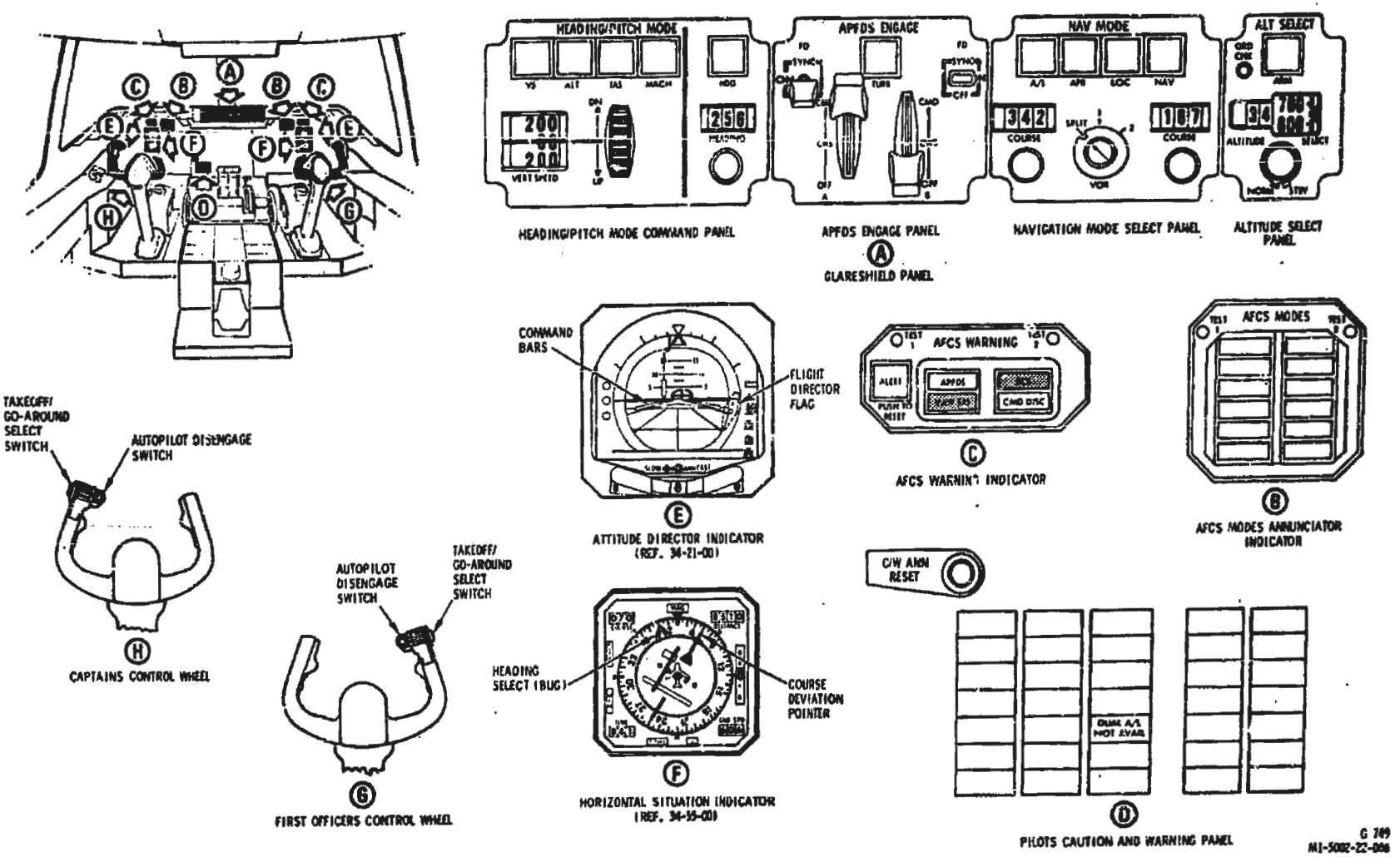
VOR navigation

Localizer

The roll command signals computed for the roll autopilot flight modes of operation (Ref. Fig. 3) are applied to the electro-hydraulic servo valve coils in the respective channels of the dual left inboard aileron servo (Ref. 27-11-00). The servo valve converts the roll command signal into a proportional hydraulic pressure to control the movement of the channel modulating piston. The displacement of the two modulating pistons are summed to control the three servo valve modules. These modules control hydraulic fluid flow and pressure to the three aileron actuators. The actuators induce aileron surface deflection proportional to the roll command signals. A LVDT (linear variable differential transducer) on each modulating piston feeds back piston position signals to the associated roll computer servo amplifiers. The modulating piston position signal is proportional to the piston stroke sensed by the LVDT. The feedback signal opposes and partially cancels the roll command signal to the servo amplifier. The two dual left inboard aileron transducers sense aileron surface deflection and convert the deflection to proportional aileron position signals. The signals are fed to their respective channels in the roll computers and summed with the roll command signal outputs from the computer voters. The feedback signals oppose the initiating roll command signals to prevent over control of the aileron and return the aileron to a trimmed position as the original error signals decrease to zero.

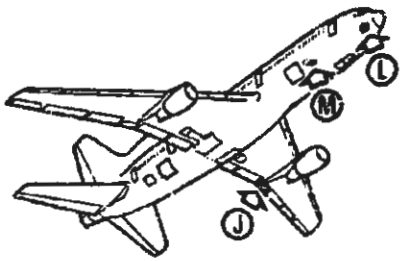
The roll command signal from the roll computer is applied to the associated attitude director indicator to drive the roll command bar.

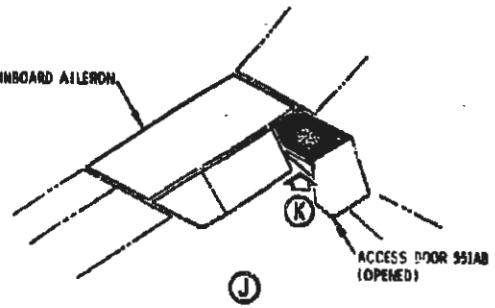
(1) Wings Level



APFDS Roll System Equipment and Location
Figure 1 (Sheet 1)

R
R
001B EFFECTIVITY: ALL





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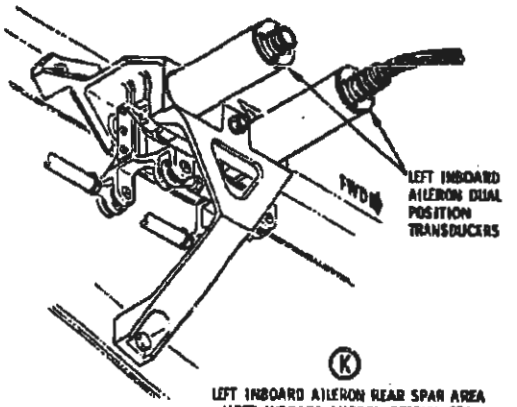
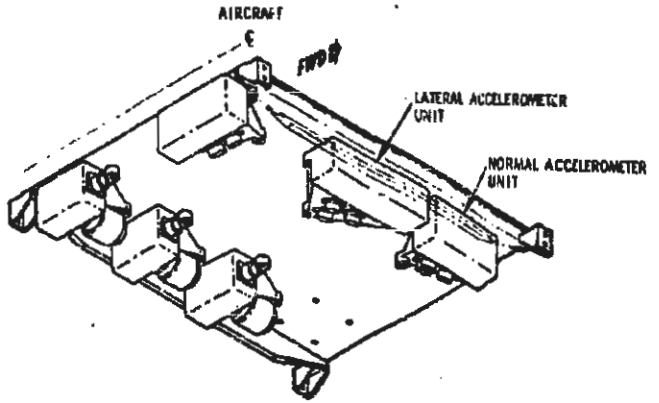
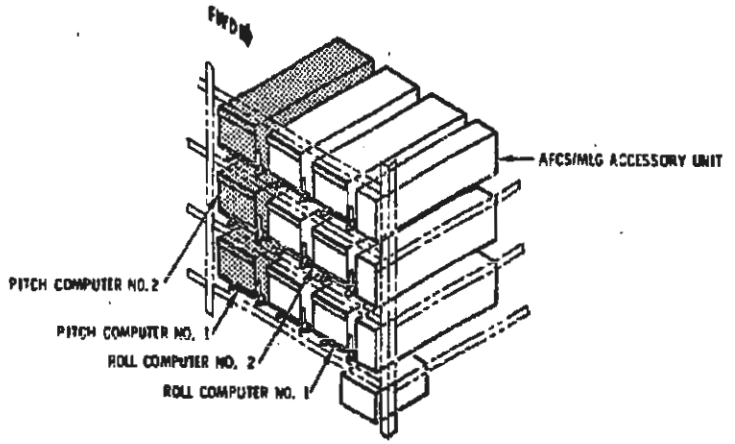


K
LEFT INBOARD AILERON REAR SPAR AREA
(LEFT INBOARD AILERON STATION 57)



M
ABOVE GALLEY CEILING
(LOOKING UP)



L
FORWARD ELECTRONIC SERVICE CENTER
CENTER RACK

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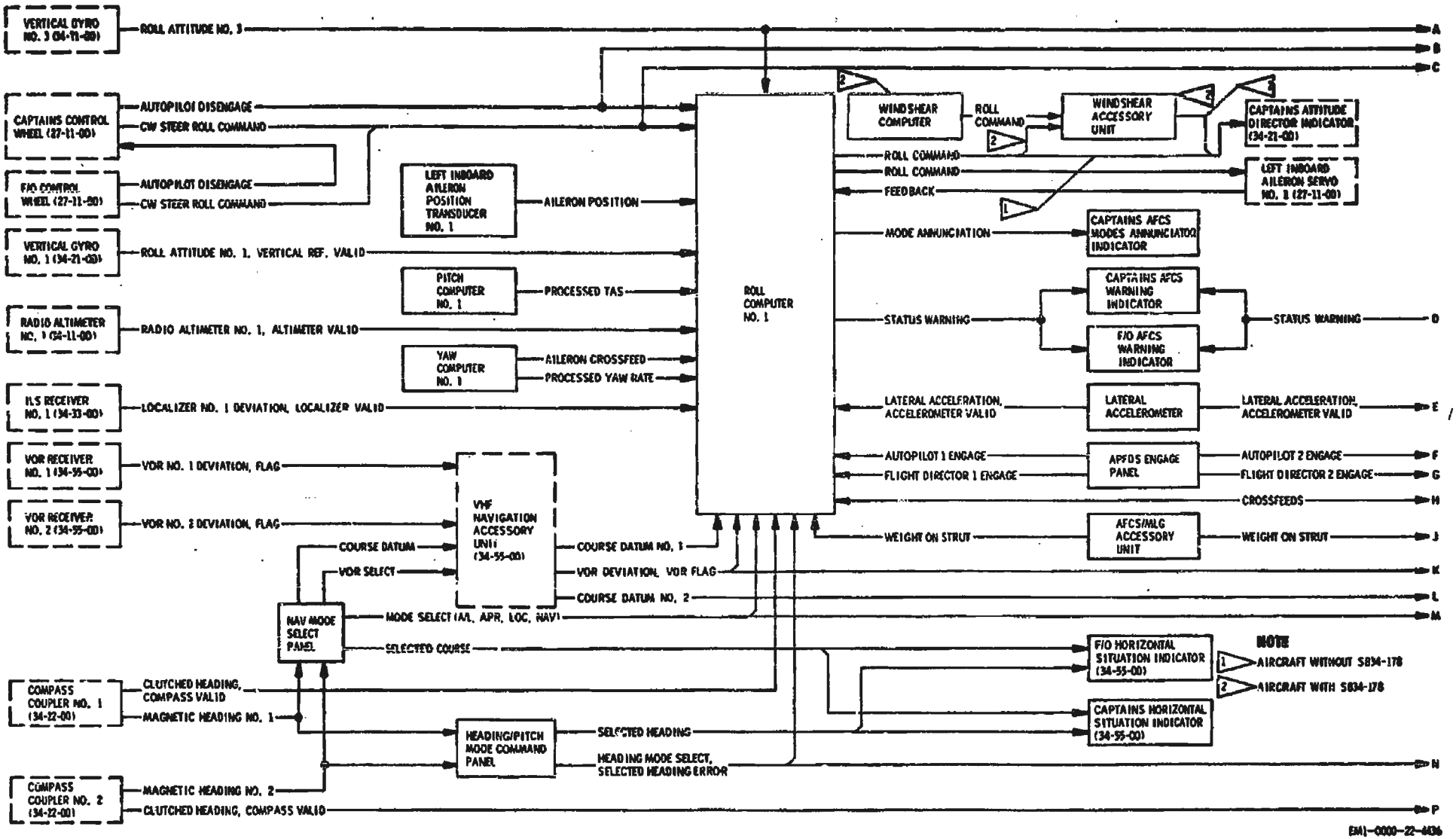
M1-0102-22-080

APFDS Roll System Equipment and Location
Figure 1 (Sheet 2)



R APFDS Roll System Interface Block Diagram
R Figure 2 (Sheet 1)

EFFECTIVITY: ALL

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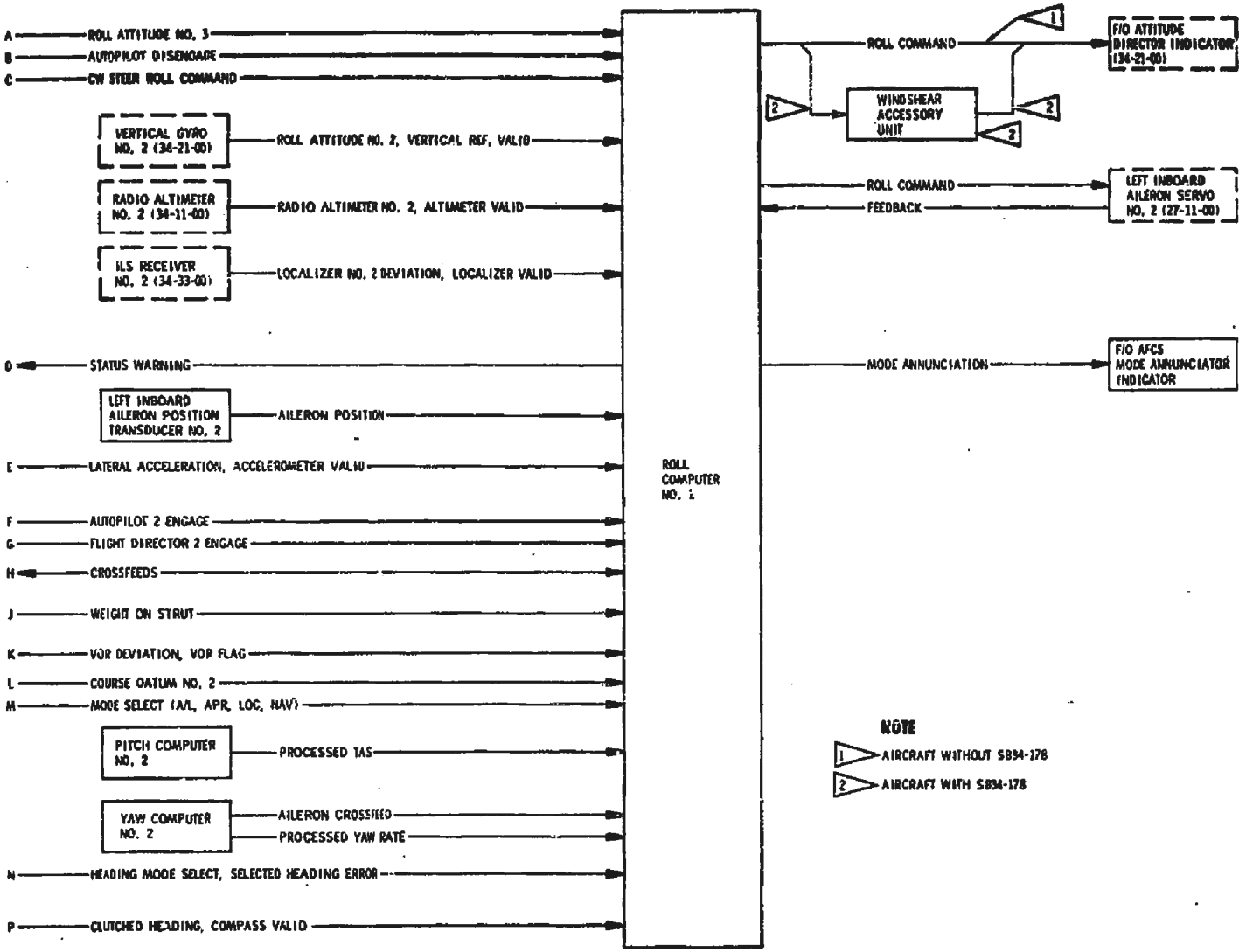

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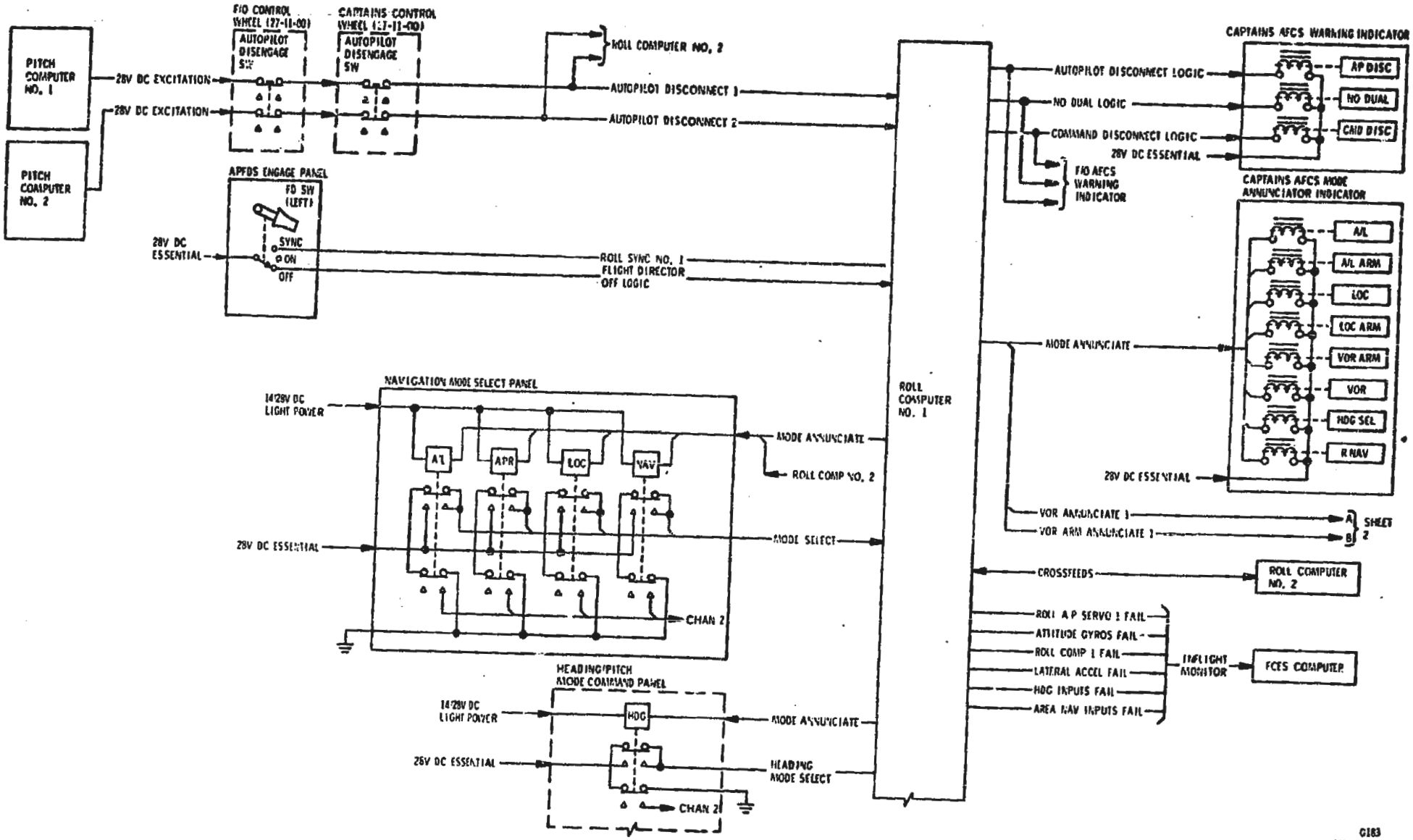
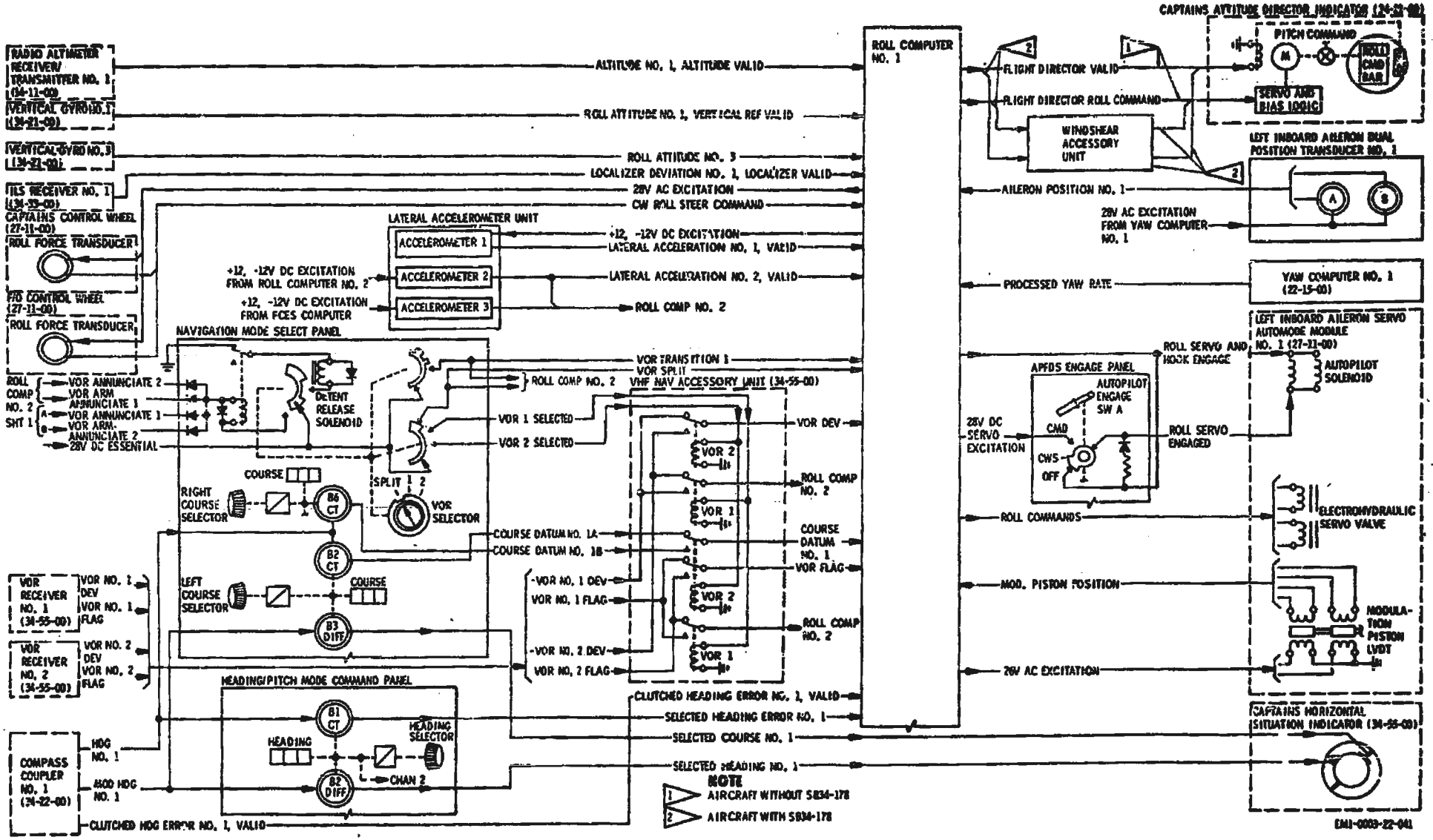
R APFDS Roll System Interface Block Diagram
R Figure 2 (Sheet 2)

EFFECTIVITY: ALL



R P Roll Channel Functional Block Diagram
Figure 3 (Sheet 1)

R R 050B EFFECTIVITY: ALL



R R Roll Channel Functional Block Diagram
Figure 3 (Sheet 2)

EFFECTIVITY: ALL

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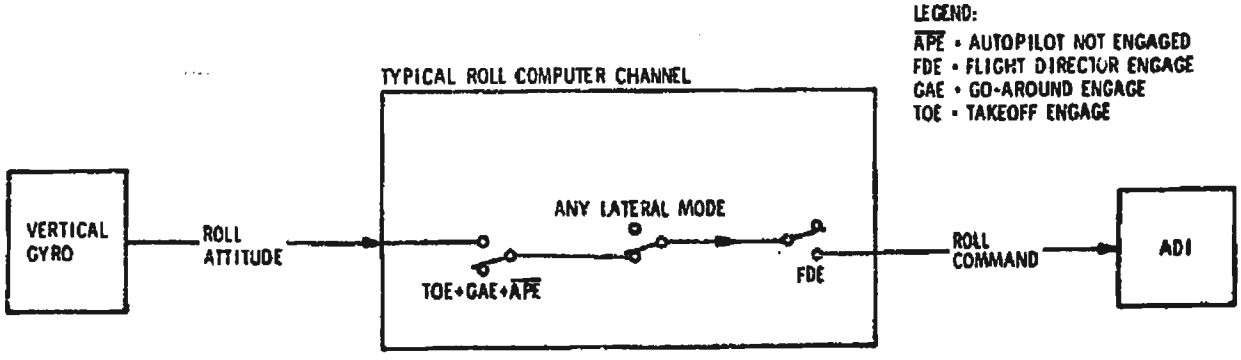
The wings-level command mode (Ref. Fig. 4) is automatically established when an autopilot is engaged, either or both flight directors are engaged, roll attitudes is less than 3 degrees and no other roll axis mode selected. In this mode, the autopilot is in the heading hold mode while the roll command bars in the ADI indicate wings level. The wings-level command signals are also generated during the go-around and takeoff configurations.

(2) Heading Hold and Bank Hold

The heading hold and bank hold modes (Ref. Fig. 5) are automatically established when either autopilot is engaged in the basic (CWS) configuration, or when the autopilot is engaged in the command (CMD) configuration with no flight path mode selected. If the aircraft bank angle is less than 3 degrees upon initial autopilot engagement, the existing aircraft heading is maintained. If the aircraft bank angle is between 3 and 35 degrees, the existing bank angle is maintained. Engagement at aircraft attitudes exceeding the maximum bank limit causes the aircraft to roll to and maintain the maximum bank angle. A new roll attitude or heading reference can be established and maintained by applying roll forces to the control wheel, flying to a new



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Wings Level Mode
Figure 4

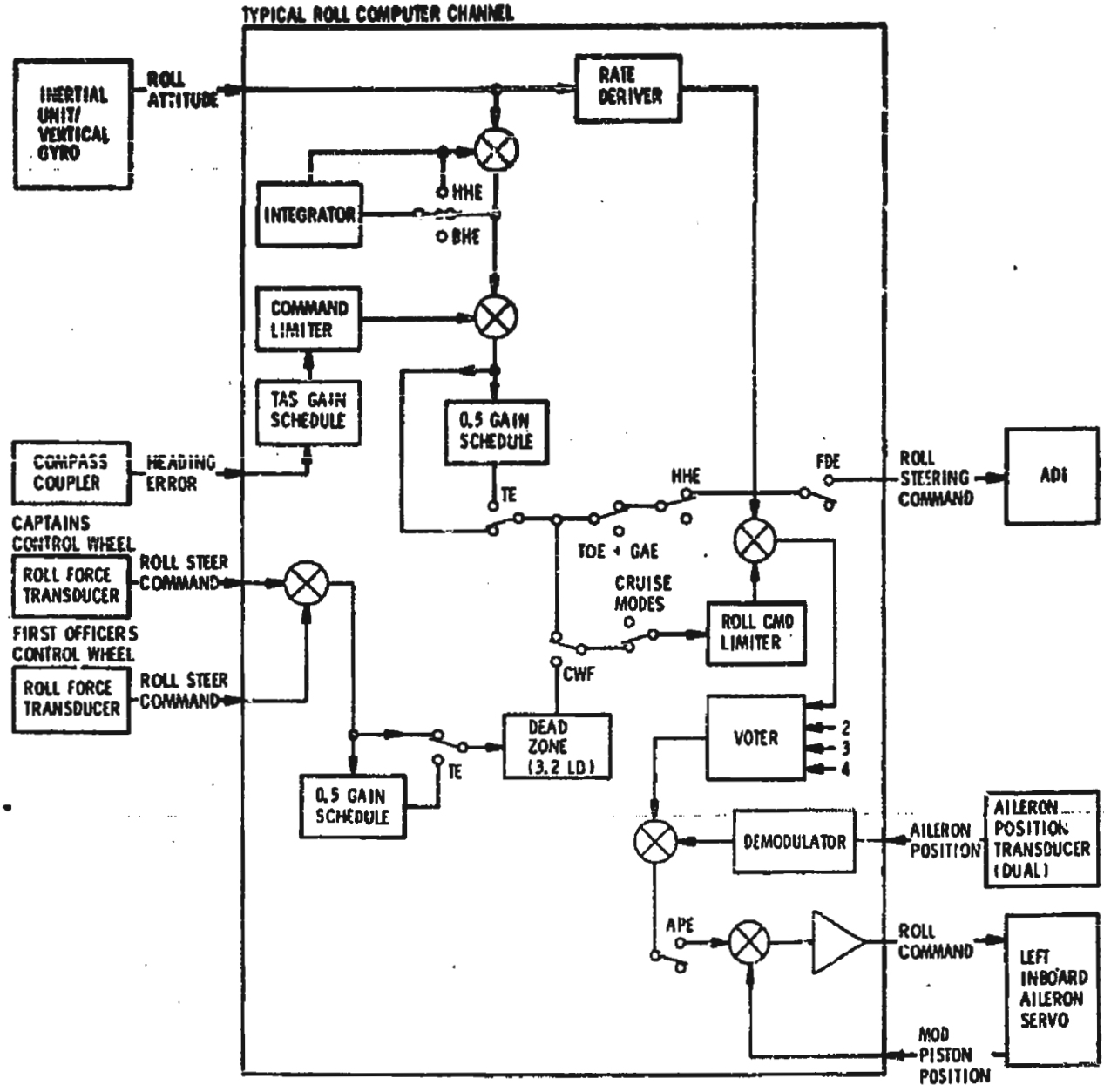
attitude or heading, and releasing the force on the control wheel.

The heading hold and bank hold modes are computed by the roll computers as a function of the clutched heading error signal from the compass coupler (Ref. 34-22-00) and roll attitude signals from the vertical
R gyros (Ref. 34-21-00) and/or inertial units (Ref. 34-43-00)When either mode is initiated, a 28V dc signal from the roll computer is applied to disengage the heading synchro clutch in the compass coupler, and establish a reference heading. Any aircraft heading deviation from the reference heading is the clutched heading error applied to the roll computer. The clutched heading error signal is gain scheduled as a function of true airspeed (processed through the pitch computer), and command limited to ±10-degree heading error.

A detector in the roll computer switches in the heading hold or bank hold circuit according to the roll attitude signal. A roll attitude less than 3 degrees, switches in the heading hold circuit which fixes the roll attitude reference to zero. A roll attitude greater than 3 degrees switches in the bank hold circuit, which fixes the roll attitude reference to the attitude existing at the time of mode initiation. The bank hold circuit also limits the bank to a maximum of 35 degrees. Any deviation in roll attitude from the reference produces a roll command error signal.

The processed clutched heading error signal is mixed with the roll attitude error signal. The resultant heading hold or bank hold signal is passed through a turbulence mode circuit where the signal gain is reduced by one-half if the turbulence mode has been selected. The signal is applied to the roll rate command limiter where the signal is limited to allow a maximum roll rate of 5 degrees per second. The resulting roll rate signal is processed through voters and servoamplifiers, and applied to the aileron servos as the roll command signal.

When either or both flight directors are engaged with the autopilot disengaged, a new roll attitude reference can be established by manually controlling the aircraft to the new roll attitude and momentarily placing either flight director (FD) switch to the SYNC position. The roll command bar on both attitude director indicators is centered and thereafter displays commands to maintain the new attitude reference.



LEGEND

APE - AUTOPILOT ENGAGE
BHE - BANK HOLD MODE ENGAGE
CWF - CONTROL WHEEL FORCE
FDE - FLIGHT DIRECTOR ENGAGE
GAE - GO-AROUND ENGAGE
HHE - HEADING HOLD MODE ENGAGE
TAS - TRUE AIRSPEED
TE - TURBULENCE MODE ENGAGE
TOE - TAKEOFF MODE ENGAGE
+ - OR
— - NOT

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Heading Hold and Bank Hold Modes
With Control Wheel Steering
Figure 5

(3) Control Wheel Steering

Control wheel steering can be used with either autopilot engaged in CWS or CMD with no cruise mode selected. The application of roll control wheel forces exceeding 2.2 pounds commands proportional roll attitude rates and provides attitude reference synchronization. After flying to a new attitude and releasing the control wheel, the new attitude is established and maintained.

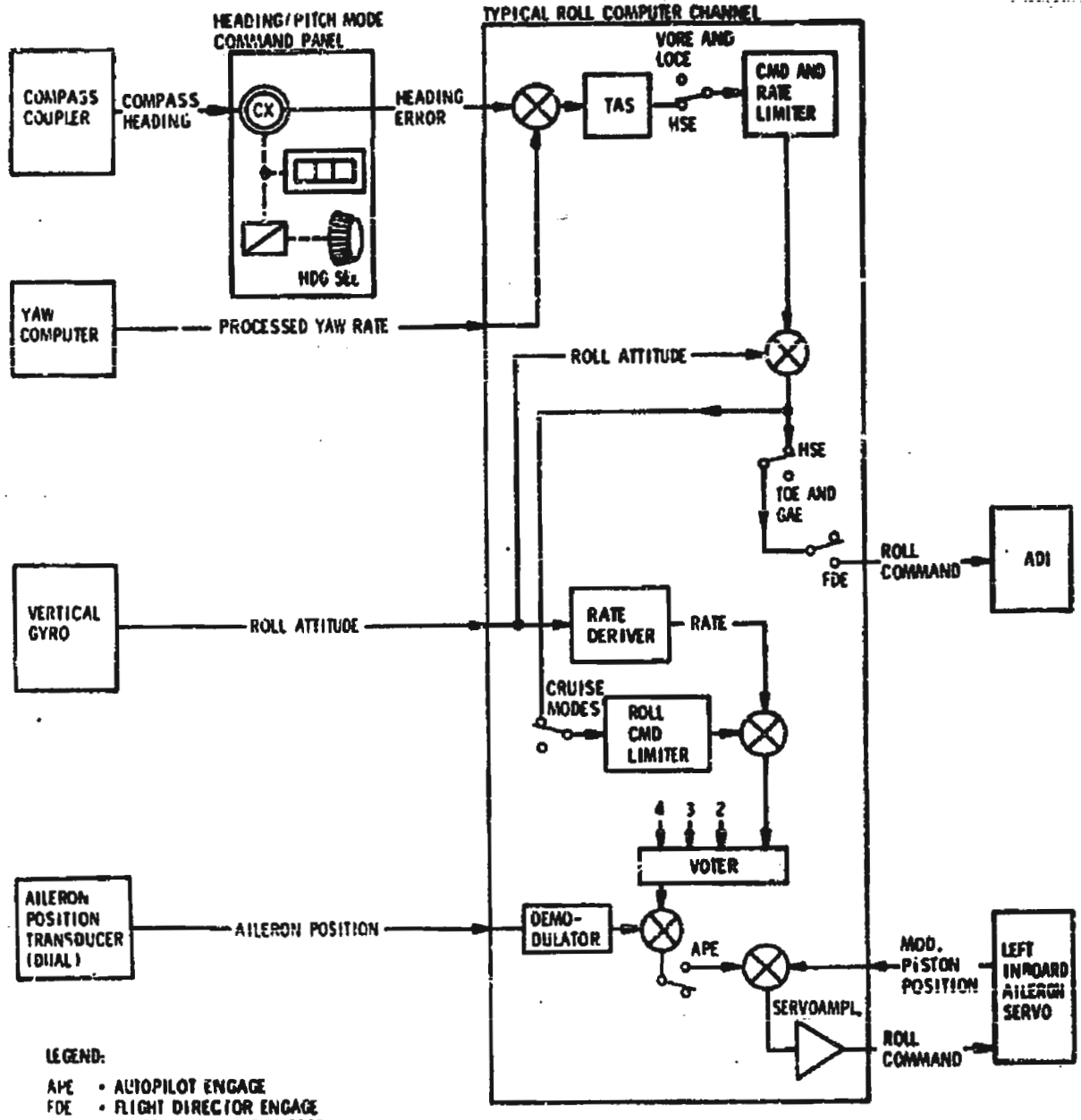
In control wheel steering, the roll computers derive the roll commands from signals received from the force sensors in the control wheel hubs and roll attitude
R signals from the attitude gyros (Ref. Fig. 5). Each roll computer receives steering signals from both the Captains and First Officers force sensors, sums the signals, and amplifies the resultant signal. The signal is fed through a dead zone to prevent unintentional pilot-applied forces from entering the autopilot channels. The signal is then summed with the heading hold or bank hold signal selected as a function
R of the roll attitude signal from the attitude gyro. The resulting signal is processed for aircraft maneuvering until the force on the control wheel is released. When the force is released, the computer command signal is held to maintain the aircraft at the attitude existing at the time the force was released.

If maximum attitude limits are exceeded by the control wheel steering operation, release of the control force causes the roll autopilot to steer the aircraft back to and maintain the maximum roll attitude.

(4) Heading Select

The HDG (heading) select mode (Ref. Fig. 6) may be engaged with either autopilot in CMD, and/or at least one FD on. The mode can be used during all phases of the flight and as a precapture guidance mode before tracking in the VOR navigation, localizer, approach, and AUTOLAND modes. The mode is also selectable after the takeoff and go-around modes are established.

A heading is selected on the HEADING/PITCH MODE panel by rotating the HEADING select knob until the desired heading is indicated on the counter. The heading select mode is then engaged by depressing the HDG switchlight on the panel. This mode provides a command computation to maneuver to and maintain the selected heading. The aircraft heading can be readjusted with the heading select mode engaged.



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R Heading Select Mode
R Figure 6

R EFFECTIVITY: ALL
R
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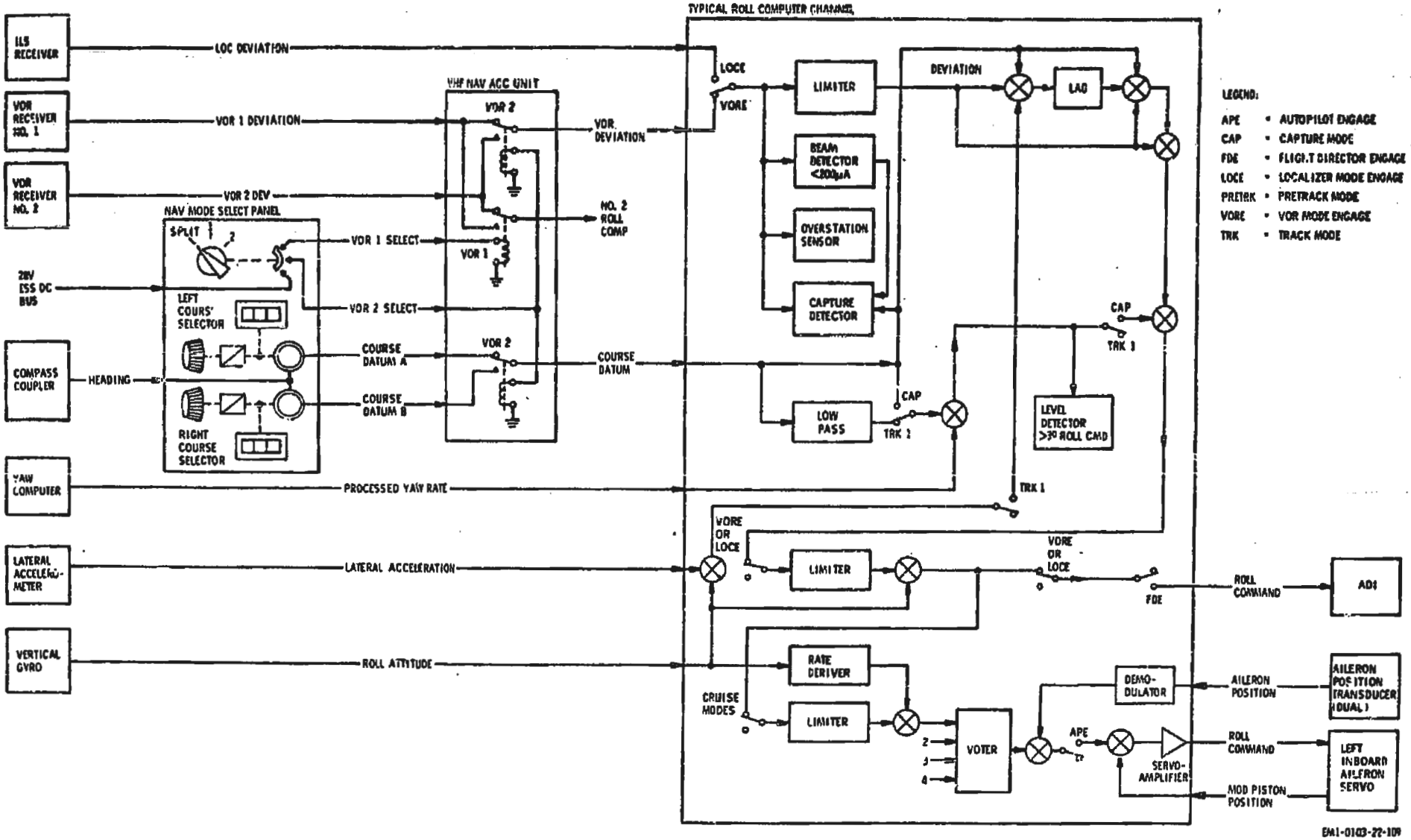
When the heading select mode is selected, the engagement causes the HDG switchlight to come on and the AFCS MODES indicators to annunciate the HDG SEL mode. The heading select mode is automatically disengaged when the turbulence (TURB) mode is selected, or when the VOR navigation (NAV), localizer (LOC), approach (APR), or AUTOLAND (A/L) mode achieves its capture.

In the heading select mode, the aircraft heading signal from the compass coupler is compared with the selected heading in the HEADING/PITCH MODE panel. An ac voltage signal proportional to the resultant heading error is applied to the roll computer. The signal is compared with the selected heading error signal crossfed from the other roll computer and then summed with the processed yaw rate signal from the associated yaw computer. The resultant signal is gain-programed relative to the processed aircraft true airspeed signal from the associated pitch computer. The gain-programed heading select error signal is then processed through limiters, filters, voters, and servoamplifiers to produce a roll command signal.

(5) VOR Navigation

The VOR navigation mode (Ref. Fig. 7) may be engaged with either autopilot in CMD, and/or at least one FD on. The VOR mode is engaged by tuning at least one VOR receiver (Ref. 34-55-00) to a VOR frequency, setting in desired course, and depressing the NAV switchlight on the NAV MODE panel. Upon mode engagement, the NAV switchlight is turned on and the VOR ARM mode is annunciated on the AFCS MODES indicators. In addition, if the heading select mode is used for precapture guidance, the HDG switchlight on the HEADING/PITCH MODE panel is turned on and the HDG SEL mode is annunciated on the AFCS MODES indicators.

The VOR mode enables the command computation to capture and maintain the selected VOR navigation radial. Capturing the selected radial is accomplished automatically with the precapture lateral guidance being either heading hold/bank hold or the heading select mode. Upon capture, the precapture guidance mode is automatically disengaged. Overstation smoothing is provided with the capability to change the selected radial for an adjusted outbound tracking reference. The VOR mode can be used with any selectable vertical guidance mode.



VOR and Localizer Modes
Figure 7

EFFECTIVITY: ALL

050B

When the NAV switchlight is on, inputs to the roll channels from the VOR receivers are controlled by the VOR select switch on the NAV MODE select panel. When VOR 1 is selected, both roll channels receive inputs from VOR receiver No. 1. Similarly, when VOR 2 is selected, both channels receive inputs from VOR receiver No. 2. When the switch is placed in the SPLIT position, the roll channels receive inputs from their respective VOR receivers. When the NAV switchlight goes out, the VOR select switch is automatically switched to the SPLIT position.

In the VOR mode, the roll command signal is generated by the roll computer as a function of the VOR deviation and course datum computations. The roll computer receives the VOR deviation signal from the VOR receiver (Ref. 34-55-00) through the VHF navigation accessory unit. The accessory unit switches VOR data No. 1 or No. 2 to the roll computer as a function of the VOR select switch on the NAV MODE select panel.

The course datum input to the roll computer is derived by the NAV MODE select panel. The panel receives the aircraft magnetic heading signal from the compass coupler and compares it with the course selected by the COURSE knob on the panel. The difference is the course datum ac voltage signal applied to the roll computer.

The roll computer uses the VOR deviation and course datum signals and the processed true airspeed from the pitch computer to determine VOR station capture, VOR track, and roll command. When the capture mode is achieved, the VOR deviation and course datum signals are summed to produce a roll command signal which causes the aircraft to bank (30 degrees maximum) toward the VOR station. The VOR capture is indicated on the AFCS MODES indicators by a change in annunciation from VOR ARM to VOR. The precapture guidance mode is disabled at this time, and if the autopilot has been in the heading select mode, the HDG SEL annunciation on the indicators goes out.

As the aircraft approaches the selected VOR beam, the VOR deviation signal begins to decrease and the aircraft starts to roll out. When the deviation signal becomes less than 30 microamperes, the roll computer is switched to the VOR track mode.

In the VOR track mode, aircraft lateral control is maintained by the roll command signal derived from the VOR deviation signal, the course datum signal, and the roll attitude signal from the attitude gyro. The roll

R

attitude signal is dampened by the lateral acceleration signal from the lateral accelerometer unit before being summed into the roll command signal computation.

When the aircraft approaches the VOR station, the roll computer is automatically switched from the track mode to the overstation mode. The switching is performed by the computer overstation sensor as a function of the erratic VOR signals encountered in the cone over the station. Aircraft heading is maintained by the memorized course datum in the overstation mode, however, course change can be made by selecting a new course on the NAV MODE select panel or by using control wheel steering. After the aircraft has passed over the station and with the erratic VOR signals no longer present, the computer automatically loses the overstation mode and captures the outbound radial.

(6) Localizer

The LOC (localizer) mode (Ref. Fig. 7) may be engaged with either autopilot in CMD, and/or at least one FD on. The localizer mode is engaged by tuning at least one ILS receiver (Ref. 34-33-00) to a localizer frequency, setting in runway heading, and depressing the LOC switchlight on the NAV MODE panel. Engagement of the localizer mode results in capturing and maintaining the selected localizer beam. Capturing of the localizer beam is accomplished automatically with the precapture; lateral guidance being either the heading hold/bank hold or the heading select mode. Upon capture, the precapture guidance mode is automatically disengaged. This mode may be used with any vertical guidance mode, except the glideslope function.

The localizer mode is engaged by depressing the LOC switchlight on the NAV MODE select panel. The mode engages if the autopilot is not engaged in the takeoff, go-around, AUTOLAND, or turbulence mode. When engaged, the LOC switchlight comes on and the LOC ARM mode is annunciated on the AFCS MODES indicators. If the precapture guidance mode is the heading select mode, the indicators also annunciate the HDG SEL mode.

The roll computer uses the localizer deviation signal from the ILS receiver (Ref. 34-33-00), the course datum signal, and the processed true airspeed signal from the pitch computer to determine localizer beam capture, roll command, and localizer track. When the aircraft captures the localizer beam, the localizer deviation and course datum signals are summed to produce a roll

command signal which starts the aircraft bank (30 degrees maximum) towards the localizer beam center. Localizer beam capture is indicated on the AFCS MODES indicators by a change in annunciation from LOC ARM to LOC. The precapture guidance mode is disabled, and if the autopilot is in the heading select mode, the HDG SEL annunciation on the indicators disappears.

As the aircraft approaches the localizer beam center, the deviation signal begins to decrease and the aircraft starts to roll out. When the deviation signal becomes less than 30 microamperes, the roll computer is switched to the LOC track mode.

In the LOC track mode, aircraft lateral control is maintained by the roll command signal derived from the localizer deviation signal, the course datum signal, and the roll attitude signal from the vertical gyro. The lateral acceleration signal input from the lateral accelerometer unit is used to dampen the roll attitude input signal. The localizer is continuously tracked when transition is made from the LOC mode to the
R approach (APR) or AUTOLAND (A/L) mode.

3. Roll Computer

A. Description

The roll computer is housed in a 3/4 ATR case. The front panel contains a fault isolation monitor annunciator, test receptacles, and a carrying handle. Mounting hooks are provided to secure the case to a rack. Two dual electrical connectors are provided on the rear of the case for system interface.

There are two identical roll computer either of which can provide roll axis control. The computers are located in the forward electronics service center. Each roll computer incorporates analog, logic, and monitoring circuits required for autopilot flight director roll axis control. Each computer contains a single computation channel for the cruise, approach, takeoff, and go-around modes of operation,
R and dual computation channels for the AUTOLAND mode.

4. Lateral Accelerometer Unit

A. Description and Operation

The lateral accelerometer unit consists of a housing mounted on a cast mount. The housing contains three identical and

independent horizontally mounted accelerometers. Each accelerometer is provided with a separate electrical receptacle on the mount.

The accelerometers are excited by +12V dc and -12V dc. The accelerometers individually sense aircraft lateral accelerations and produce proportional voltages which are applied to the using dual system. The unit is mounted with the line-of-flight arrowhead point forward. This orientation causes the accelerometers to produce a positive voltage for a lateral acceleration towards the right wing.

R The lateral accelerometers provide the roll computers signals during the approach and AUTOLAND modes of operation. Signal trace wires from roll computers through accelerometers insure that units are connected.

5. Left Aileron Dual Position Transducer

A. Description and Operation

The left inboard aileron dual position transducer is a dual synchro transmitter which senses aileron surface position and converts the surface position to proportional dual synchro signals which are used as feedback signals. The transducer is comprised of two independent synchros with a common rotor shaft and an electrical receptacle. The exposed portion of the rotor shaft is serrated and grooved for installation purposes. The transducer housing at the rotor shaft end is circumferentially grooved for mounting purposes. Electrical zero (EZ) index marks are provided on the housing and the rotor shaft for alignment during installation.

Movement of the left inboard aileron rotates the transducer rotor shaft. The angular displacement of the rotor shaft is proportional to the aileron position, and the direction of shaft rotation depends on the direction of aileron movement. As the transducer rotor shaft is displaced from EZ (zero aileron deflection), the displacement is induced in the stators of the two synchros. The stator signals output are 200 millivolts ac per degree of aileron deflection and are in phase with each other. The outputs are positive with upward aileron deflection and negative with downward aileron deflection. The transducer synchros are excited by 26V ac, 400 Hz power.

6. AFCS MODES Annunciator

A. Description

There are two AFCS MODES annunciators, one located on the Captains instrument panel and the other on the First Officers instrument panel (Ref. Fig. 1). The AFCS MODES annunciator provides a visual display of the APFDS operating modes when they are engaged. Following is a list of the APFD roll system operating modes displayed: A/L, A/L ARM, LOC ARM, LOC, VOR ARM, VOR, HDG SEL, and R NAV. For a detailed description of the annunciator, see 21-10-00.

7. AFCS WARNING Indicator

A. Description

There are two AFCS WARNING indicators, one located on the Captains instrument panel and the other on the First Officers instrument panel (Ref. Fig. 1). The AFCS WARNING indicators provide visual displays when failures are detected in AFCS operation that require immediate pilot action. Following is a list of APFD roll system warnings displayed: AP DISC, NO DUAL, and CMD DISC. For a detailed description of the indicator, see 22-10-00.

8. APFDS ENGAGE Panel

A. Description

The APFDS ENGAGE panel is located in the center of the glareshield panel (Ref. Fig. 1). The panel provides control to engage autopilots A and B, flight directors A and B, and turbulence mode. For a detailed description of the panel, see 22-10-00.

9. HEADING/PITCH MODE Panel

A. Description

The HEADING/PITCH MODE panel is located on the left side of the glareshield panel (Ref. Fig. 1). The panel provides selection of APFDS lateral and vertical modes of operation. Only the HDG hold mode switchlight is used by the APFD roll system. Depressing the HDG switchlight engages the heading hold mode. A lamp in the switchlight indicates that HDG hold mode is engaged. For a detailed description of the panel, see 22-10-00.

10. NAV MODE Panel

A. Description

The NAV MODE panel is located on the right side of the glareshield panel (Ref. Fig. 1). The NAV MODE panel provides selection of APFDS navigation modes of operation, and selection of APFDS course data inputs. For a detailed description of the panel, see 22-10-00. Following is a list of the APFD roll system panel controls/indications and their functions:

CONTROL/INDICATION	FUNCTION
A/L mode switchlight	Initiates selection of AUTOLAND mode of operation
APR mode switchlight	Initiates selection of approach mode of operation
LOC mode switchlight	Initiates selection of localizer mode of operation
NAV mode switchlight	Initiates selection of navigation mode of operation
Left COURSE knob	Permits selection of course for autopilot A and flight director A
Right COURSE knob	Permits selection of course for autopilot B and flight director B
Left Digital COURSE readout	Displays course selected for autopilot A and flight director A
Right Digital COURSE readout	Displays course selected for autopilot B and flight director B
VOR knob	Selects either VOR No. 1 or VOR No. 2. Returns to SPLIT automatically when LOC, APR, or A/L modes are selected

11. AFCS/MLG Accessory Unit

A. Description

The AFCS/MLG accessory unit is located in the forward electronic service center, center rack (Ref. Fig. 1). The unit provides the roll computers signals that indicate whether the aircraft is airborne or on the ground. Removal of the unit during ground testing simulates aircraft airborne. For a detailed description of the unit, see 22-10-00.

12. System Interface

The APFD roll system interfaces with the following equipment:

34-21-00 Attitude Director Indicator

31-22-00 Aural Warning Unit

27-11-00 Autopilot Disconnect Switch (Part of Control Wheel)

34-22-00 Compass Coupler

34-55-00 Horizontal Situation Indicator

34-33-00 ILS Receiver

27-11-00 Left Inboard Aileron Servo Module

22-11-00 Pitch Computer

34-32-00 Radio Altimeter

27-11-00 Roll Force Transducer (Part of Control Wheel)

34-21-00 Vertical Gyro

R 34-43-00 Inertial Navigation System

34-55-00 VHF NAV Accessory Unit

34-55-00 VOR Receiver

22-15-00 Yaw Computer

AUTOPILOT-FLIGHT DIRECTOR ROLL SYSTEM - FAULT ISOLATION

1. Fault Isolation/Identification

Table 101 lists faults and the procedures for required fault isolation of the autopilot-flight director roll system.

Since no fault isolation system can cover every potential failure, schematics are provided. The schematics provide the necessary information to trace signal flow and functional logic flow from source to termination.

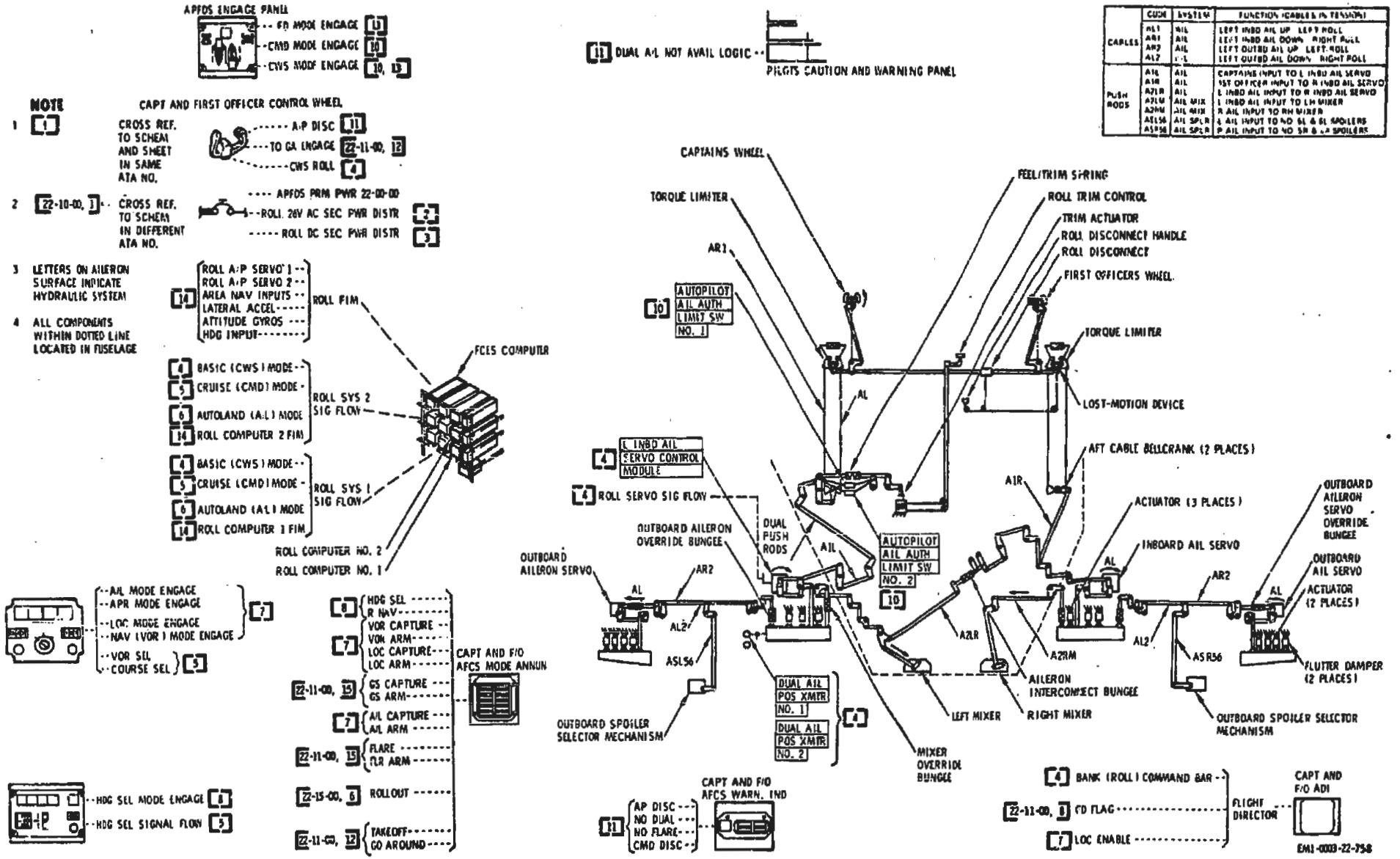
For troubleshooting aircraft wiring, use tables on schematics for listing of applicable diagram in wiring diagram manual. Table 102 lists all autopilot-flight director roll system fault isolation diagrams and schematics.

Autopilot/Flight Director Roll System Fault Isolation
Table 101

	FAULT SYMPTOM	FAULT ISOLATION	PAGE
R	FLIGHT DIRECTOR INOPERATIVE	22-10-31	101
	FLIGHT DIRECTOR OPERATES INTERMITTENTLY	22-10-31	101
	FLIGHT DIRECTOR WILL NOT ACCEPT SELECTED MODE:		
	HDG SELECT MODE	22-13-31	101
	NAV (VOR) MODE	22-13-35	101
	LOC MODE	22-12-19	101
	APR MODE	22-12-21	101
	A/L MODE	22-14-31	101
	TAKEOFF MODE	22-12-29	101
	FLIGHT DIRECTOR CMD BAR INDICATES RIGHT TURN WITH WINGS LEVEL	22-10-31	101
	AUTOPILOT WILL NOT ENGAGE IN CWS OR CMD	22-10-33	101
	NO DUAL MESSAGE	22-14-31	101
	DUAL A/L NOT AVAIL LIGHT	22-12-37	101
	GO AROUND MODE	22-12-39	101

R Autopilot-Flt Dir Roll Sys Fault Isolation Diagrams
R Table 102

SCHEM NO.	TITLE
1	Roll System Schematic Locator
2	Roll 26 VAC Secondary Power Distribution Schematic
3	Roll DC Secondary Power Distribution Schematic
4	Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic
5	Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic
6	Roll Systems No. 1 and No. 2 AUTOLAND Mode Signal Flow Schematic
7	A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic
8	HDG SEL, HDG Hold, Capture, A/L TRK-B and R-NAV Mode Engage (Exclusive Mode) Logic Schematic
9	A/L TRK A, TRK 1, VOR/LOC Capture, OS and LOC TRK Mode Engage Logic Schematic
10	Roll Servo Engage/Valid and Roll Valid Logic Schematic
11	A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic
12	Roll Voter Switching and Valid Processing Logic Schematic
13	Roll Command Enable and FD Valid Logic Schematic
14	Roll FIM Schematic



	CUSH	SYSTEM	FUNCTION (CABLES IN TENSION)
CABLES	AL1	AIL	LEFT INBD AIL UP LEFT ROLL
	AR1	AIL	LEFT INBD AIL DOWN RIGHT ROLL
	AR2	AIL	LEFT OUTBD AIL UP LEFT ROLL
	AL2	AIL	LEFT OUTBD AIL DOWN RIGHT ROLL
PUSH RODS	AIL	AIL	CAPTAINS INPUT TO L INBD AIL SERVO
	AIR	AIL	1ST OFFICER INPUT TO R INBD AIL SERVO
	A2LR	AIL	L INBD AIL INPUT TO R INBD AIL SERVO
	A2LM	AIL MIX	L INBD AIL INPUT TO LH MIXER
	A2RM	AIL MIX	R AIL INPUT TO RH MIXER
	ASL56	AIL SPLR	L AIL INPUT TO NO 5L & 6L SPOILERS
	ASR56	AIL SPLR	R AIL INPUT TO NO 5R & 6R SPOILERS

R R Roll System Schematic Locator SCHEM 1

EFFECTIVITY: ALL

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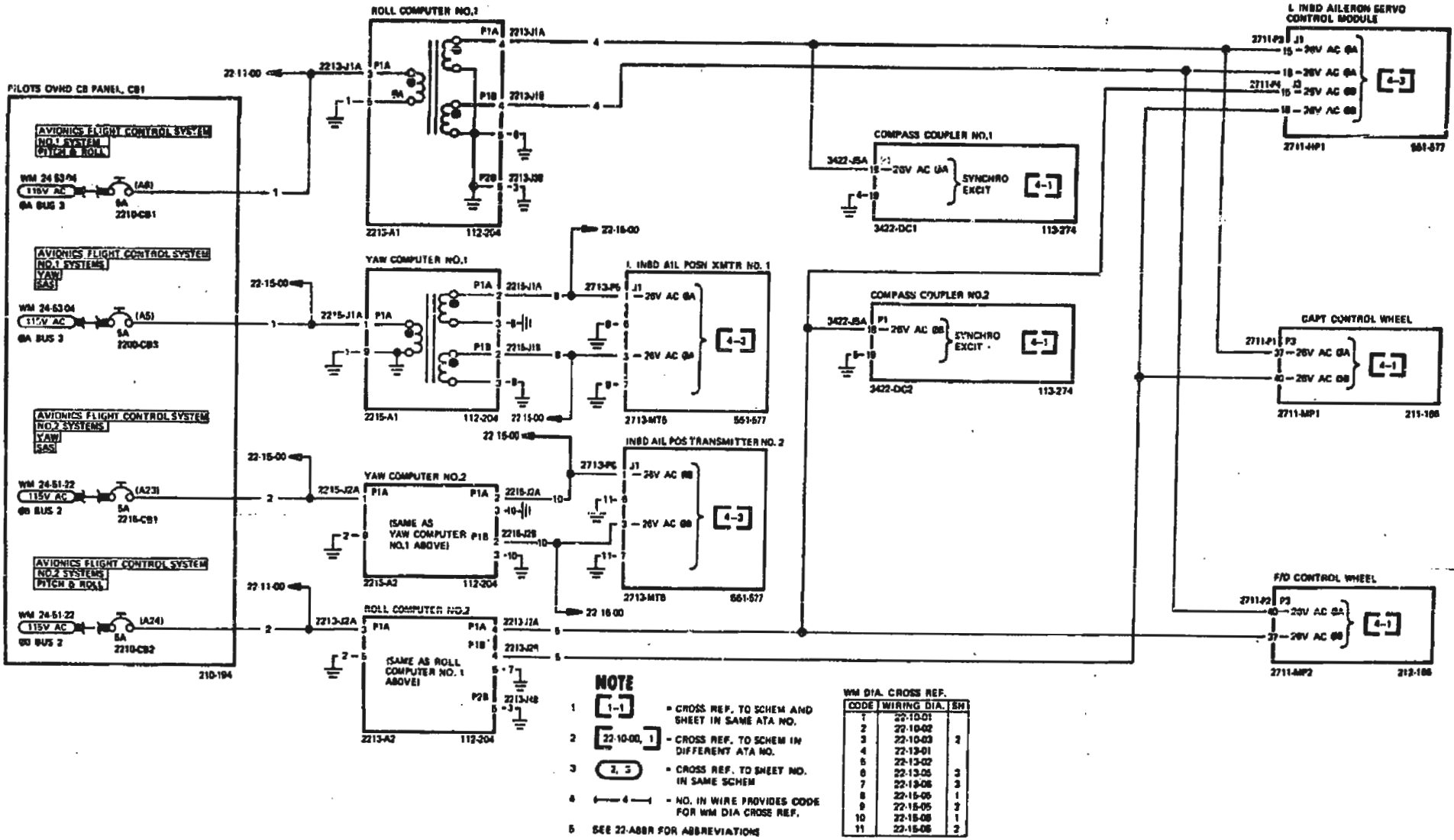
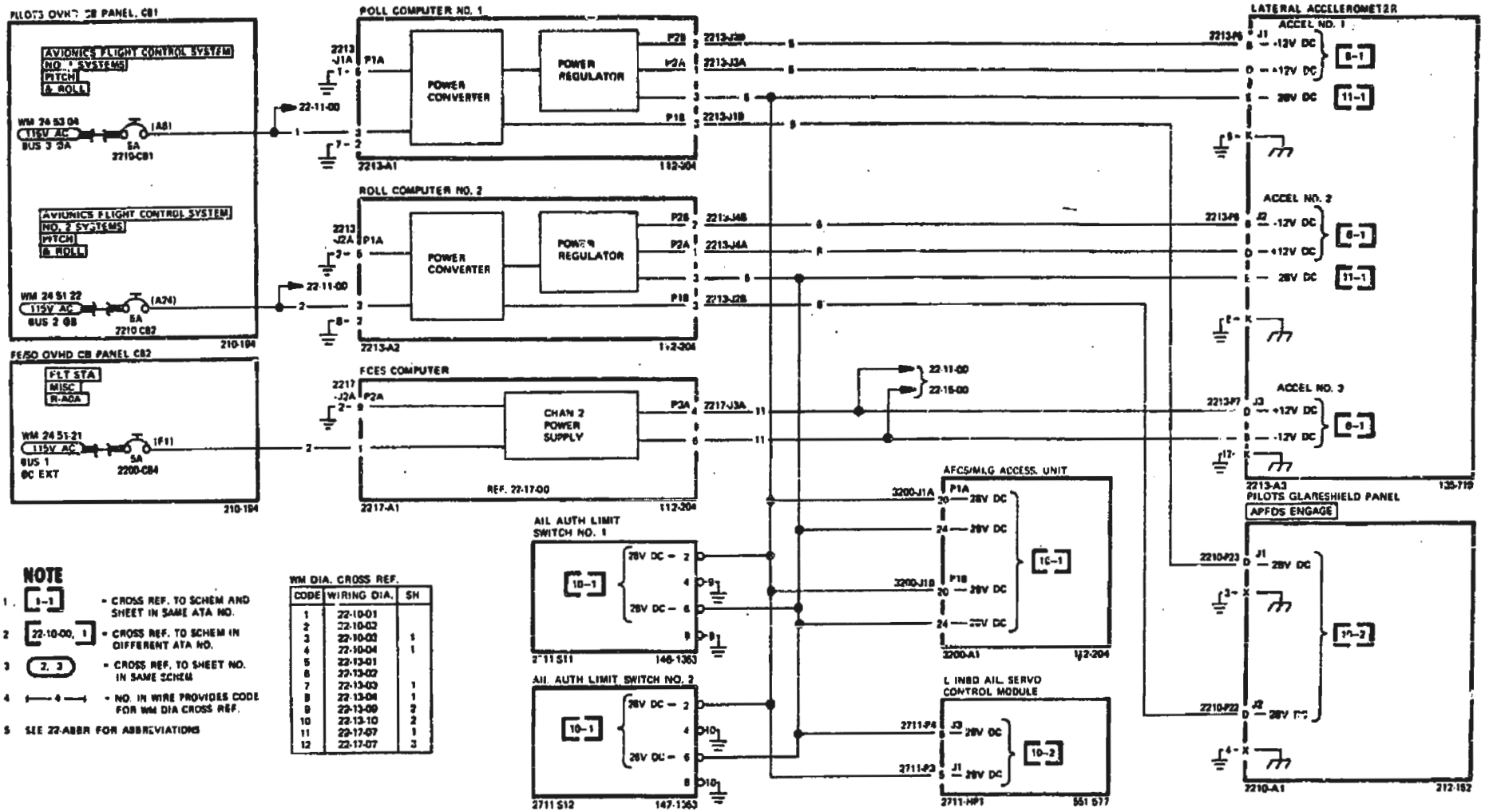

ROLL COMPUTER NO.1
PILOTS OVHD CB PANEL, CB1
AVIONICS FLIGHT CONTROL SYSTEM NO.1 SYSTEM PITCH & ROLL
AVIONICS FLIGHT CONTROL SYSTEM NO.1 SYSTEMS YAW SAS
AVIONICS FLIGHT CONTROL SYSTEM NO.2 SYSTEMS YAW SAS
AVIONICS FLIGHT CONTROL SYSTEM NO.2 SYSTEMS PITCH & ROLL
YAW COMPUTER NO.1
YAW COMPUTER NO.2
(SAME AS YAW COMPUTER NO.1 ABOVE)
ROLL COMPUTER NO.2
(SAME AS ROLL COMPUTER NO. 1 ABOVE)
L INBD AIL POSN XMTR NO. 1
INBD AIL POS TRANSMITTER NO. 2
L INBD AILERON SERVO CONTROL MODULE
COMPASS COUPLER NO.1
COMPASS COUPLER NO.2
CAPT CONTROL WHEEL
F/O CONTROL WHEEL
SYNCHRO EXCIT
26V AC 0A
26V AC 0B
NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA. CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-10-01
2 | 22-10-02
3 | 22-10-03 | 2
4 | 22-13-01
5 | 22-13-02
6 | 22-13-05 | 2
7 | 22-13-06 | 3
8 | 22-15-05 | 1
9 | 22-15-05 | 2
10 | 22-15-06 | 1
11 | 22-15-06 | 2
EM1-0008-22-846

R Roll 26 VAC Secondary Power Distribution Schematic
R SCHEM 2

EFFECTIVITY: ALL

0018



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA. CROSS REF.

CODE	WIRING DIA.	SH
1	22-10-01	
2	22-10-02	
3	22-10-03	1
4	22-10-04	1
5	22-13-01	
6	22-13-02	
7	22-13-03	1
8	22-13-04	1
9	22-13-09	2
10	22-13-10	2
11	22-17-07	1
12	22-17-07	3

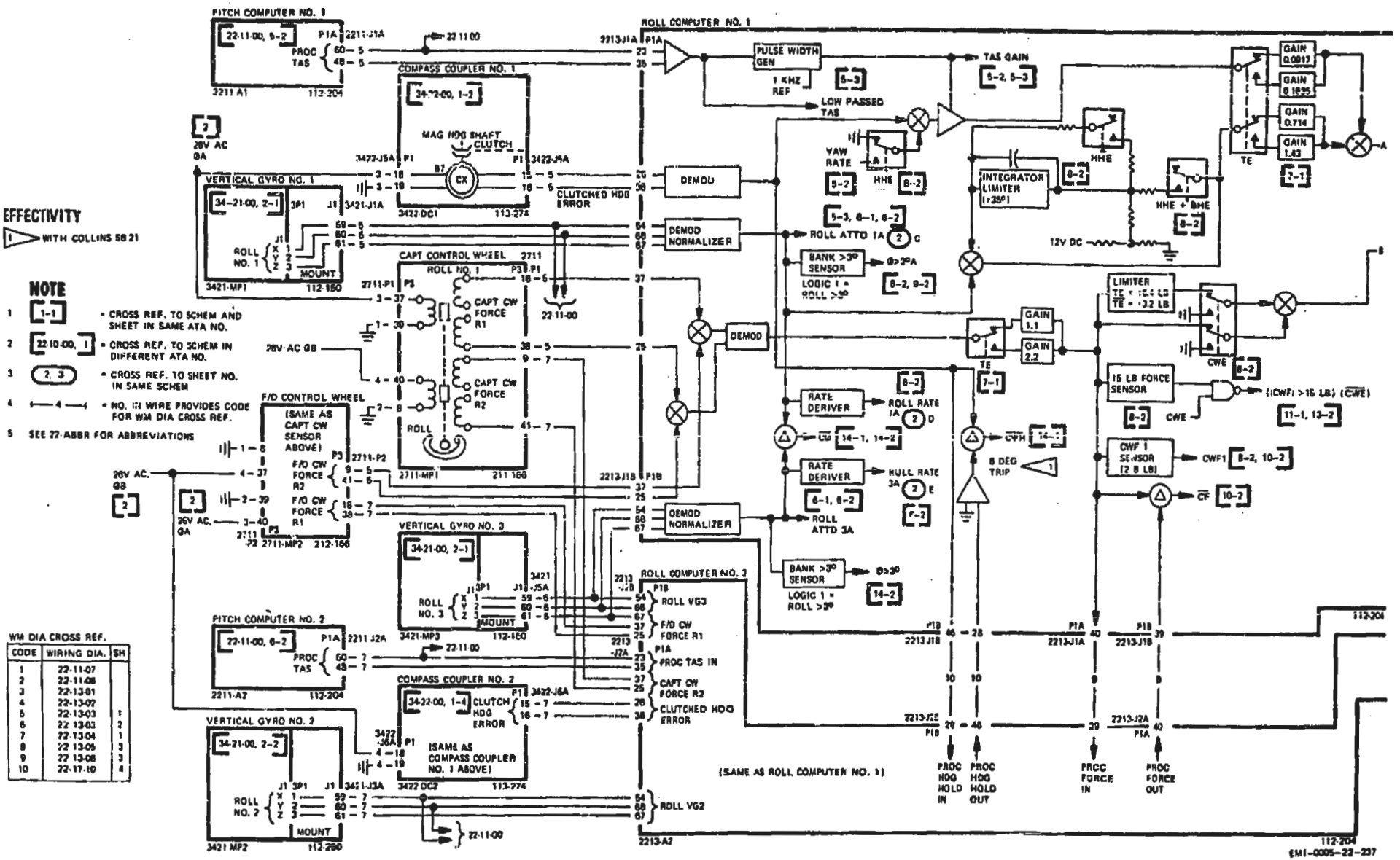
EM1--0005-22--n48

R
R

Roll DC Secondary Power Distribution Schematic
SCHEM 3

EFFECTIVITY: ALL

0018



EFFECTIVITY

1 ▷ WITH COLLINS 58 21

NOTE

1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

3 (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM

4 ⟵4⟶ • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

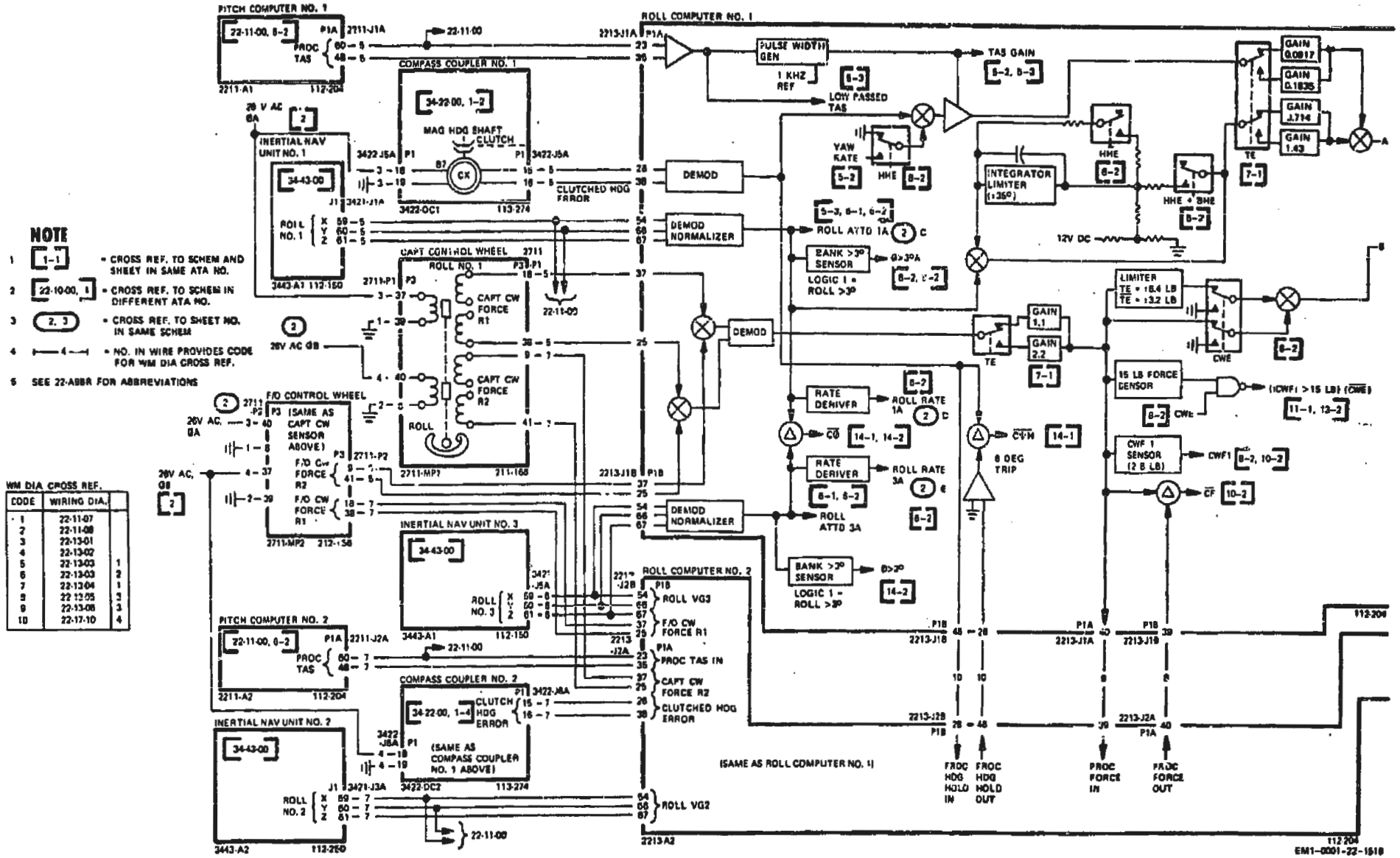
5 SEE 22-ABBR FOR ABBREVIATIONS

WM DIA CROSS REF.

CODE	WIRING DIA.	SH
1	22-11-07	
2	22-11-08	
3	22-13-81	
4	22-13-02	
5	22-13-03	1
6	22-13-03	2
7	22-13-04	1
8	22-13-05	3
9	22-13-06	3
10	22-17-10	4

Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic
SCHEM 4 (Sheet 1)

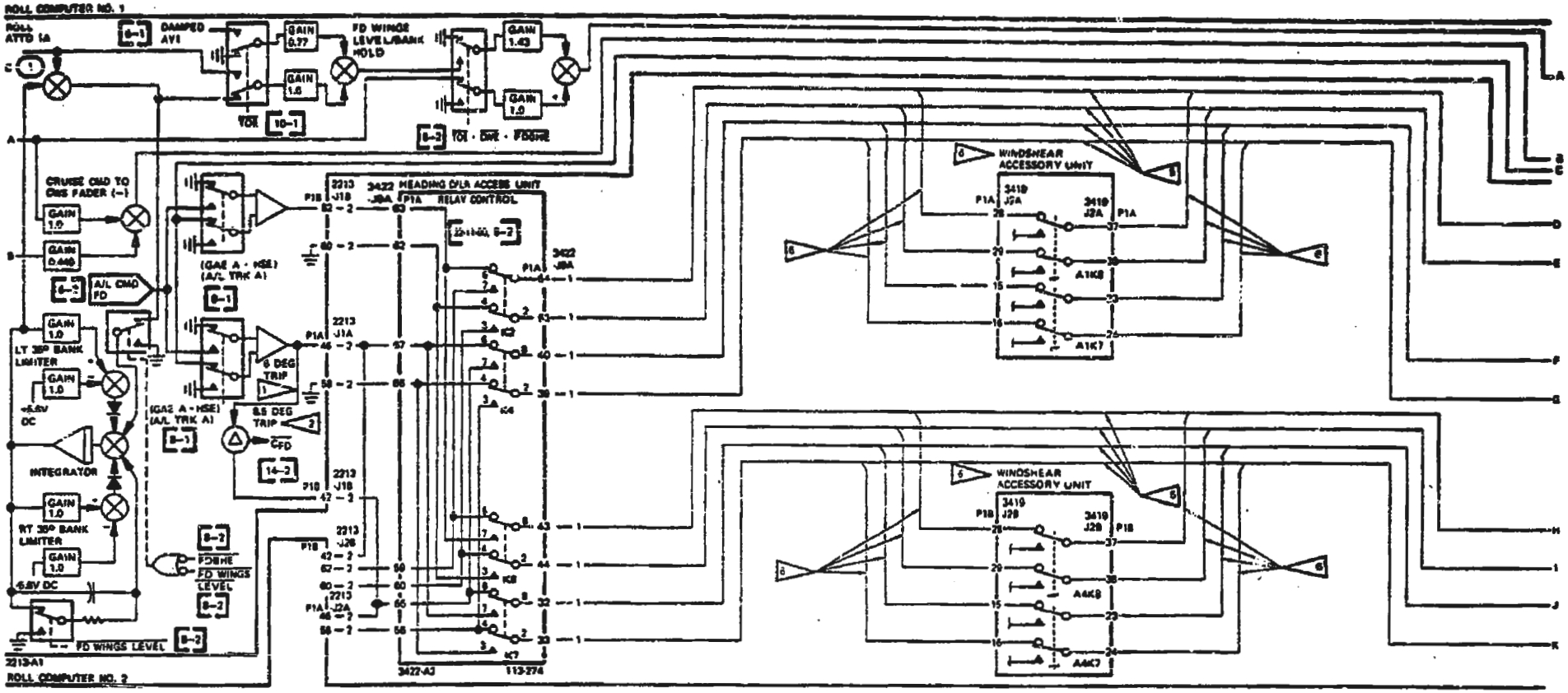
R
R
001B EFFECTIVITY: C01-024, 027


PITCH COMPUTER NO. 1
ROLL COMPUTER NO. 1
COMPASS COUPLER NO. 1
INERTIAL NAV UNIT NO. 1
CAPT CONTROL WHEEL
F/O CONTROL WHEEL
INERTIAL NAV UNIT NO. 3
PITCH COMPUTER NO. 2
COMPASS COUPLER NO. 2
INERTIAL NAV UNIT NO. 2
ROLL COMPUTER NO. 2
PULSE WIDTH GEN
1 KHZ REF
LOW PASSED TAS
TAS GAIN
YAW RATE
INTEGRATOR LIMITER (±25°)
DEMOD
DEMOD NORMALIZER
RATE DERIVER
BANK >3° SENSOR
LOGIC 1 = ROLL >3°
8 DEG TRIP
LIMITER
15 LB FORCE SENSOR
CWF 1 SENSOR (2.8 LB)
MAG HDG SHAFT CLUTCH
CLUTCHED HDG ERROR
CAPT CW FORCE R1
CAPT CW FORCE R2
F/O CW FORCE R1
F/O CW FORCE R2
ROLL VG3
ROLL VG2
PROC TAS IN
PROC HDG HOLD IN
PROC HDG HOLD OUT
PROC FORCE IN
PROC FORCE OUT
(SAME AS ROLL COMPUTER NO. 1)
(SAME AS COMPASS COUPLER NO. 1 ABOVE)
(SAME AS CAPT CW SENSOR ABOVE)
NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA.
1 | 22-11-07
2 | 22-11-08
3 | 22-13-01
4 | 22-13-02
5 | 22-13-03 1
6 | 22-13-03 2
7 | 22-13-04 1
8 | 22-13-05 3
9 | 22-13-06 3
10 | 22-17-10 4

R Roll System No. 1 and No. 2 Basic Mode Signal Flow Schematic
R SCHEM 4 (Sheet 1)

EFFECTIVITY: 025, 026, 028-999

0018



2213-A2

NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. ⟨— 4 —⟩ = NO. IN WIRE PROVIDES CODE FOR WIRE DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WIRE DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-10-05	2
2	22-10-06	3
3	22-13-03	2
4	22-13-04	2

NOTE

1. WITHOUT COLLINS SB 34
2. WITH COLLINS SB 34
3. WITHOUT COLLINS SB 38
4. WITH COLLINS SB 38
5. AIRCRAFT WITHOUT SB34-178
6. AIRCRAFT WITH SB34-178

NOTE

"A" = (A/L TRK A + (GAEA · HSE)) (APSMDA + DAP CMD A)

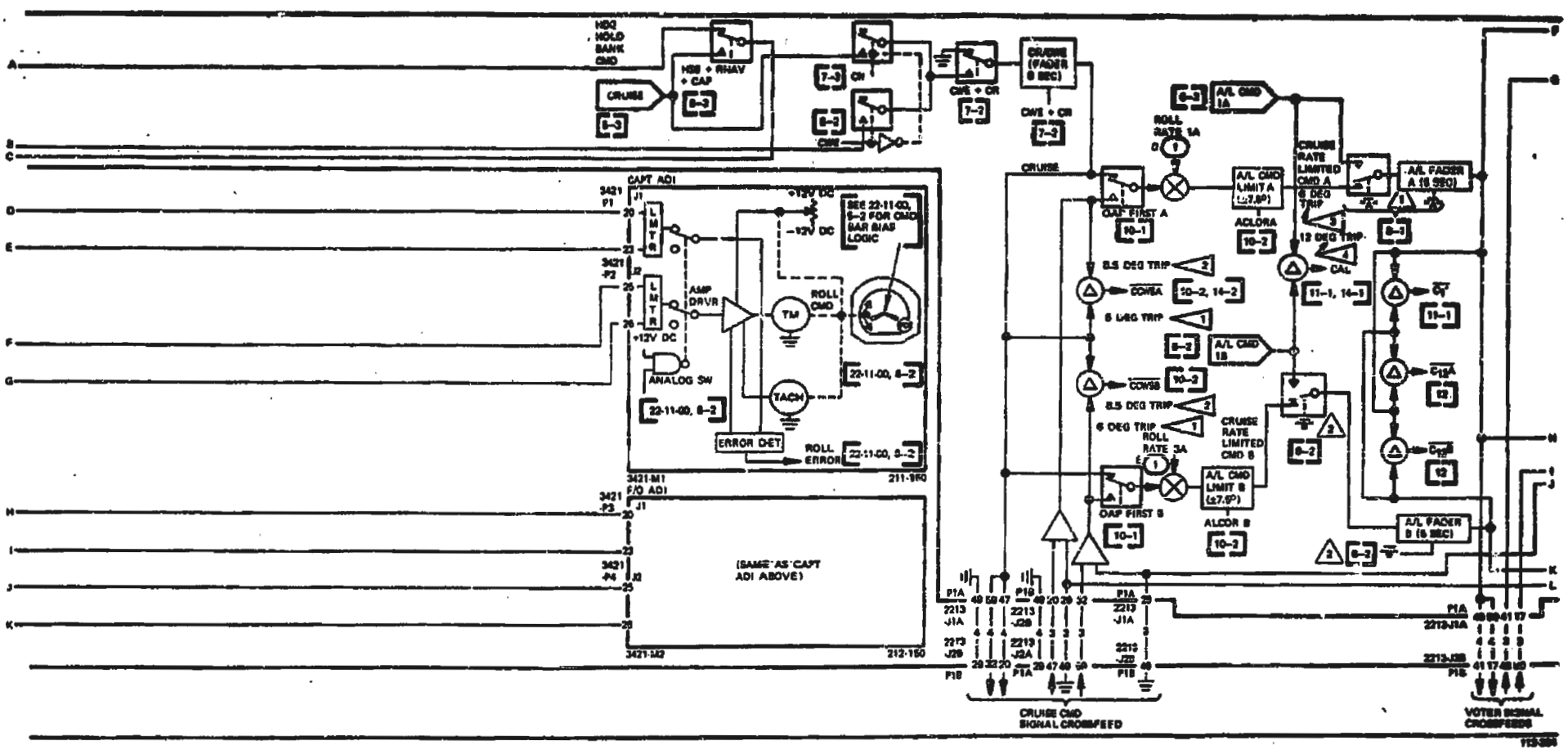
"B" = (A/L TRK B + (GAEB · HSE)) (APSMDB + DAP CMD B)

EM1-0000-22-4479

R Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic
R SCHEM 4 (Sheet 2)

EFFECTIVITY: ALL

001B

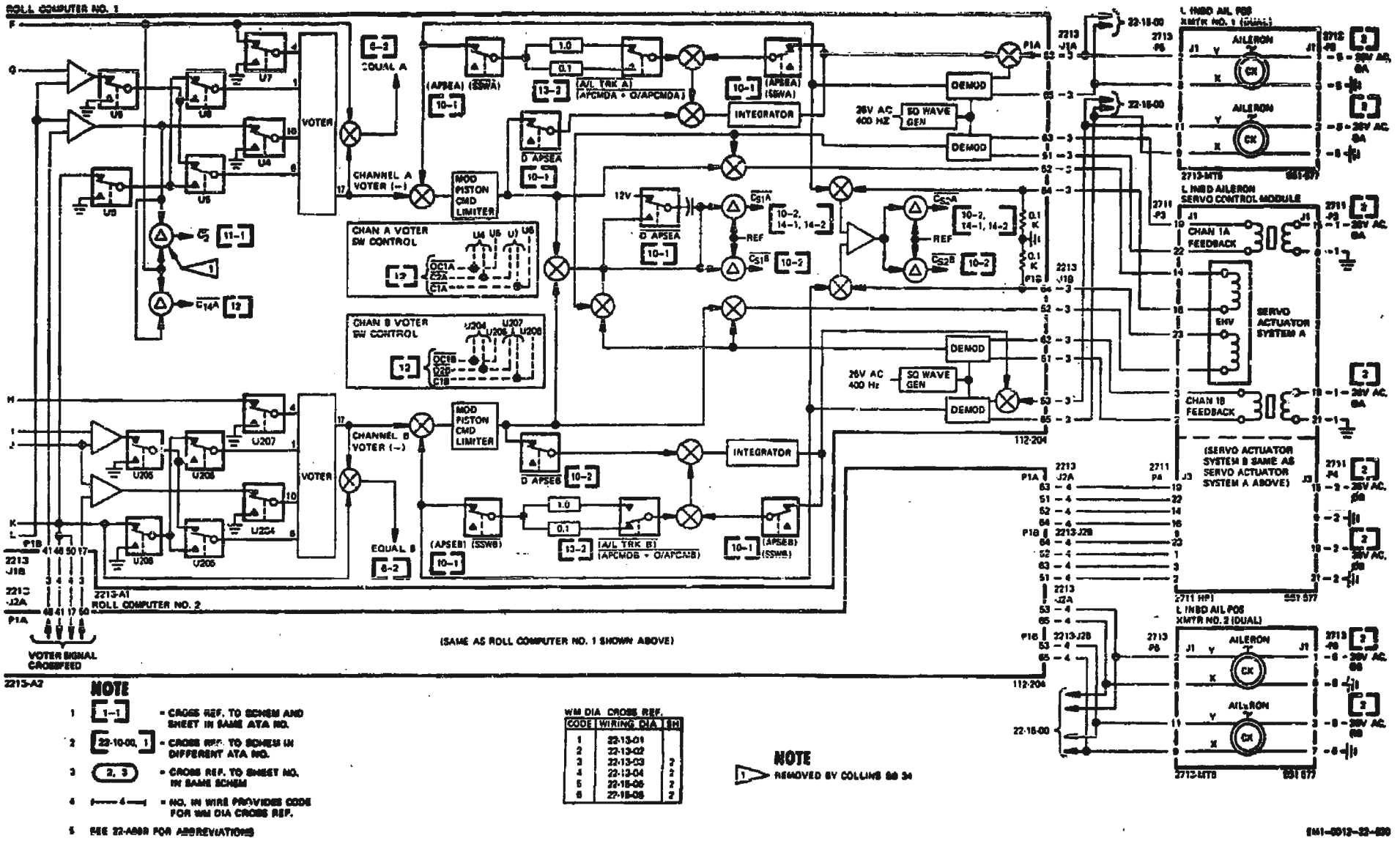


SM1-0000-22-4481

R Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic
R SCHEM 4 (Sheet 3)

EFFECTIVITY: ALL

001B



NOTE

1. [1–1] – CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] – CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) – CROSS REF. TO SHEET NO. IN SAME SCHEM
4. ⟵4⟶ – NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-A00 FOR ABBREVIATIONS

WM DIA CROSS REF.

CODE	WIRING DIA	IH
1	22-13-01	
2	22-13-02	
3	22-13-03	2
4	22-13-04	2
5	22-15-05	2
6	22-15-06	2

NOTE

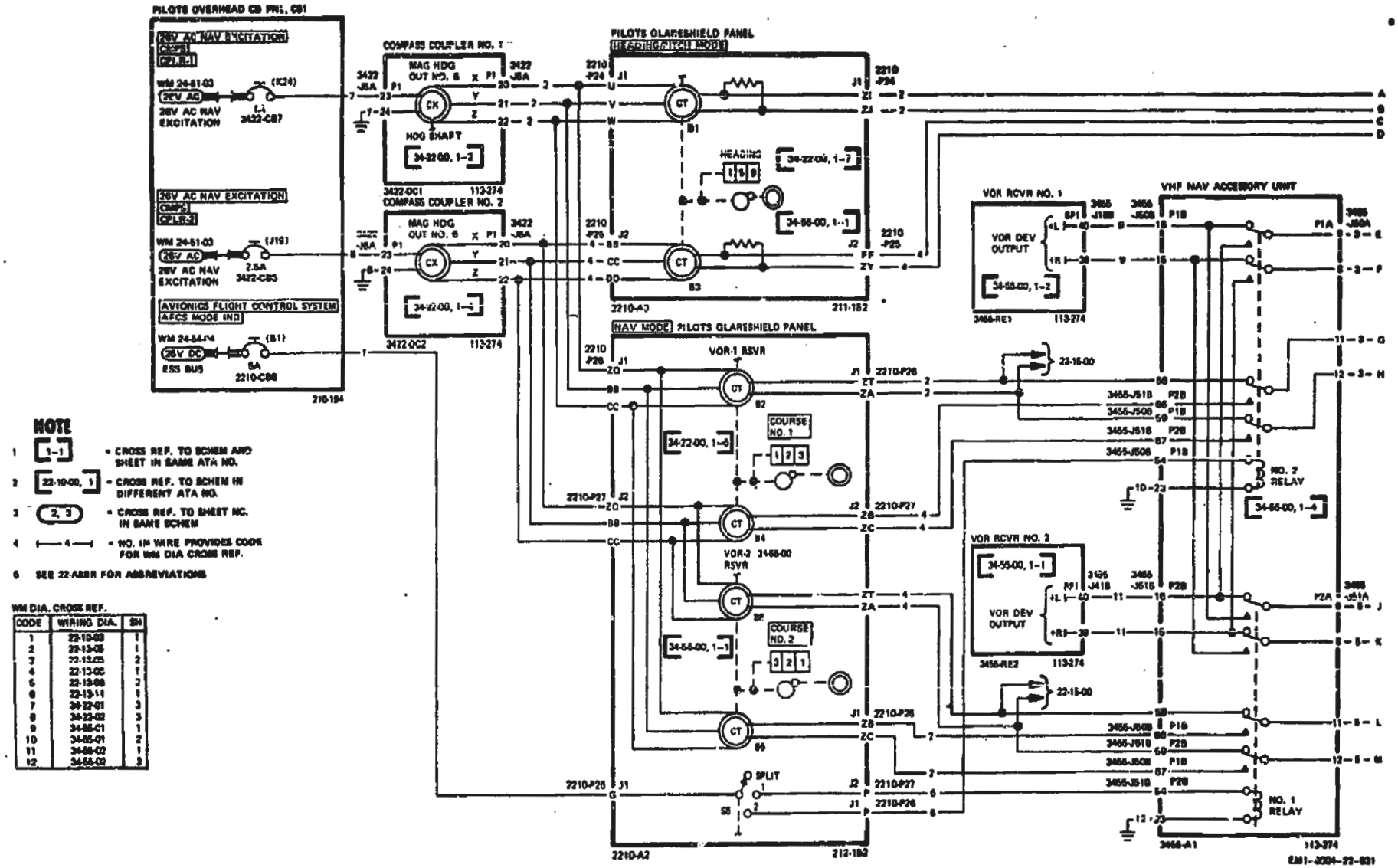
1. REMOVED BY COLLINS SB 34

EM1-0013-22-030

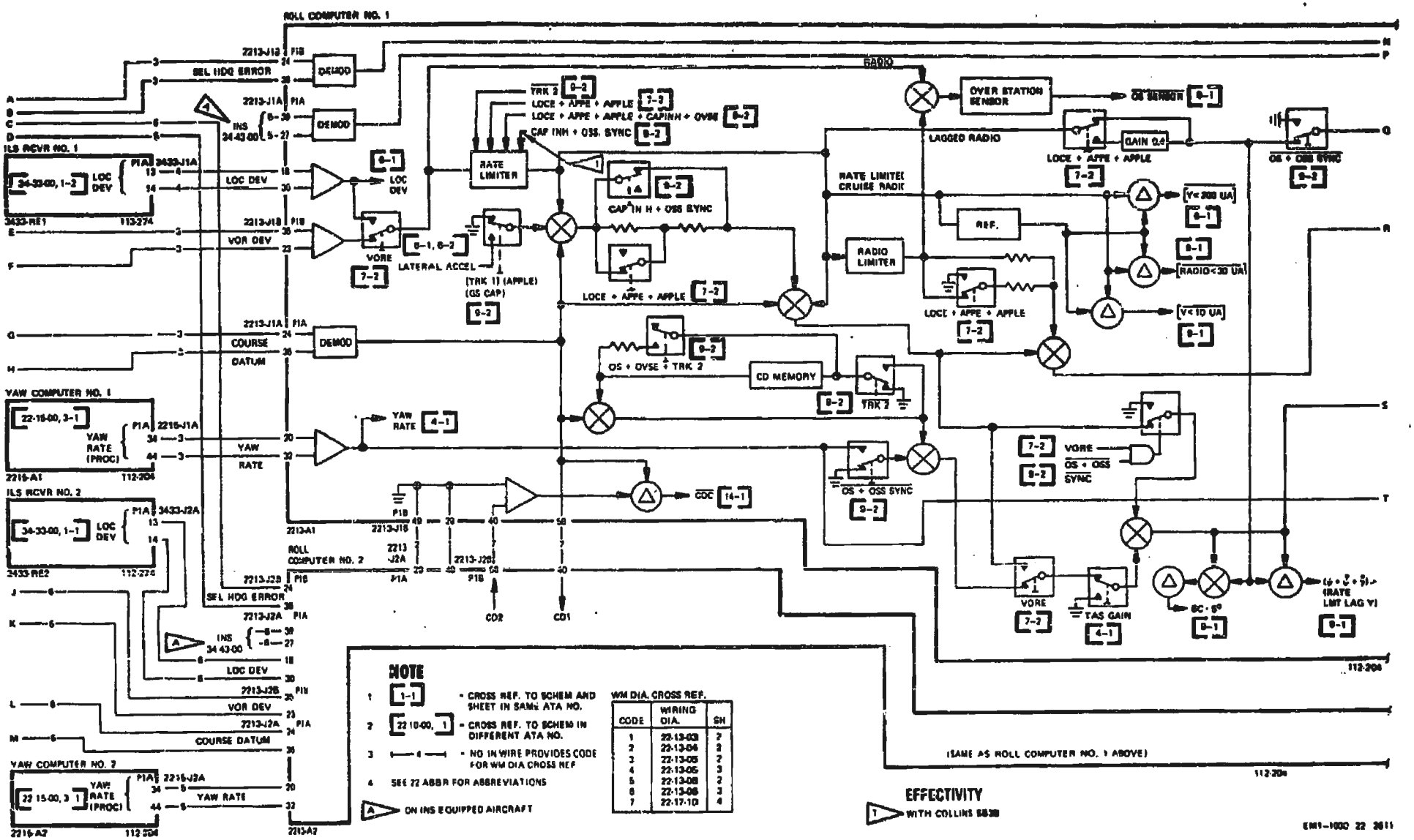
R Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic
R SCHEM 4 (Sheet 4)

EFFECTIVITY: ALL

001B

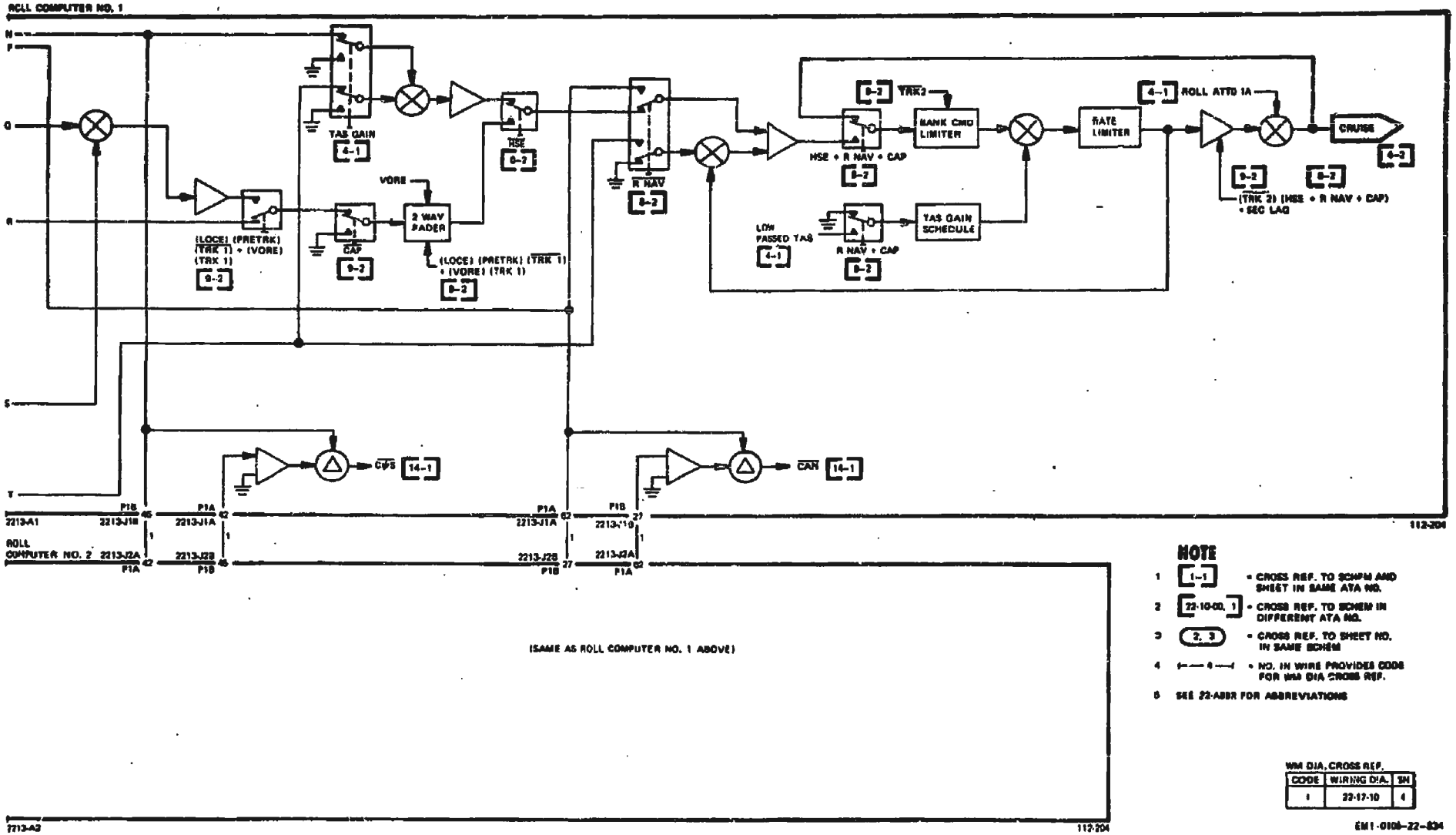

PILOTS OVERHEAD CB PNL, C81
28V AC NAV EXCITATION
CMPS
CPLR-1
28V AC NAV EXCITATION
CMPS
CPLR-2
AVIONICS FLIGHT CONTROL SYSTEM
AFCS MODE IND
28V DC
ESS BUS
2210-C88
COMPASS COUPLER NO. 1
COMPASS COUPLER NO. 2
MAG HDG OUT NO. 1
MAG HDG OUT NO. 2
HDG SHAFT
PILOTS GLARESHIELD PANEL
NAV MODE PILOTS GLARESHIELD PANEL
VOR-1 RSVR
VOR-2 RSVR
COURSE NO. 1
COURSE NO. 2
HEADING
SPLIT
VOR RCVR NO. 1
VOR RCVR NO. 2
VOR DEV OUTPUT
VHF NAV ACCESSORY UNIT
NO. 1 RELAY
NO. 2 RELAY
NOTE
1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA. CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-13-03 | 1
2 | 22-13-05 | 1
3 | 22-13-05 | 2
4 | 22-13-05 | 1
5 | 22-13-06 | 2
6 | 22-13-11 | 1
7 | 34-22-01 | 3
8 | 34-22-02 | 3
9 | 34-55-01 | 1
10 | 34-55-01 | 2
11 | 34-55-02 | 1
12 | 34-55-02 | 3

Roll System No. 1 and No. 2 CMD Mode Signal Flow Schematic
SCHEM 5 (Sheet 1)



C Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic
C SCHEM 5 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



NOTE

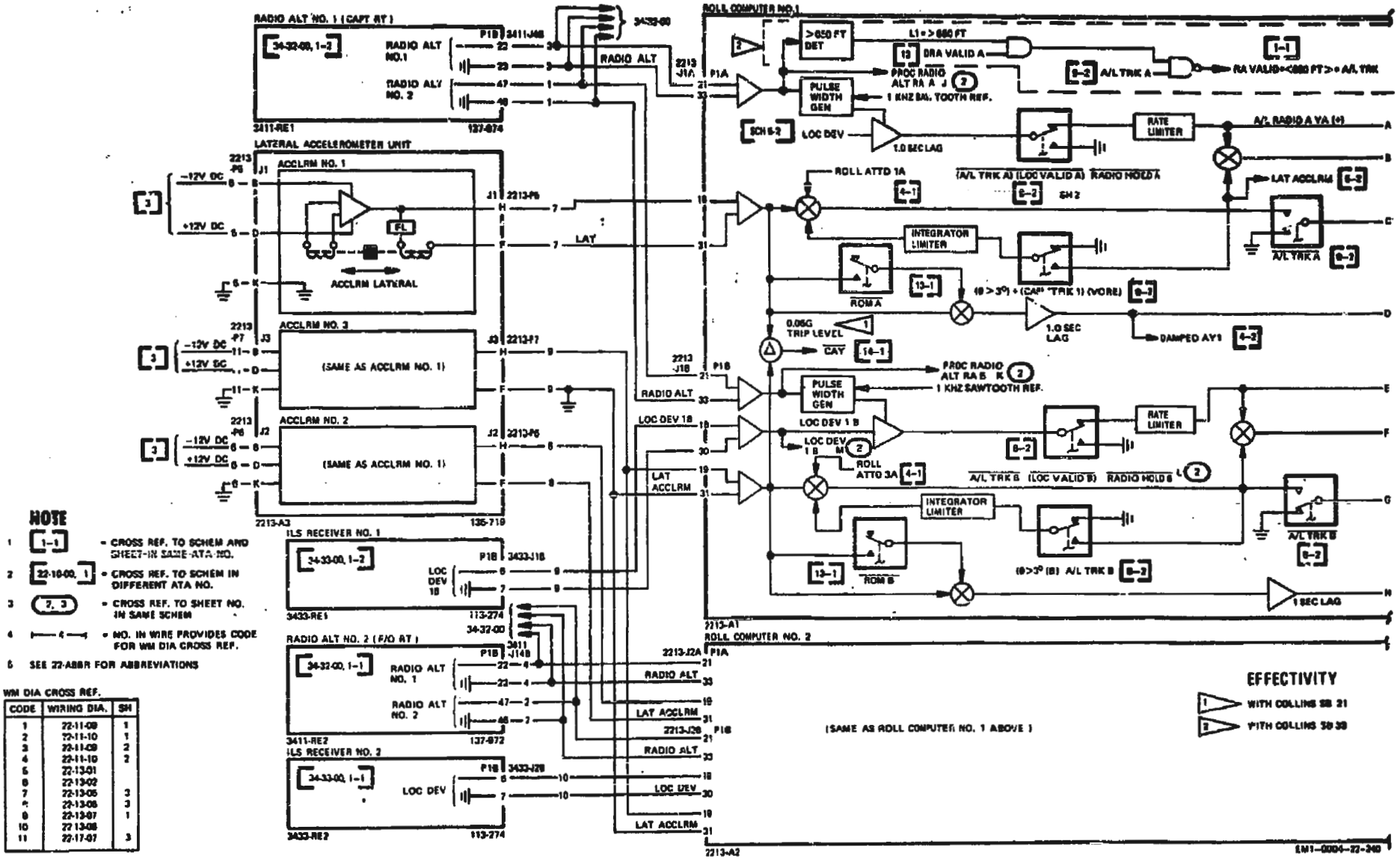
1. [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4. ←— 6 —→ • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA. CROSS REF.

CODE	WIRING DIA.	SH
1	22-17-10	4

EM1-0108-22-834

Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic
SCHEM 5 (Sheet 3)



NOTE

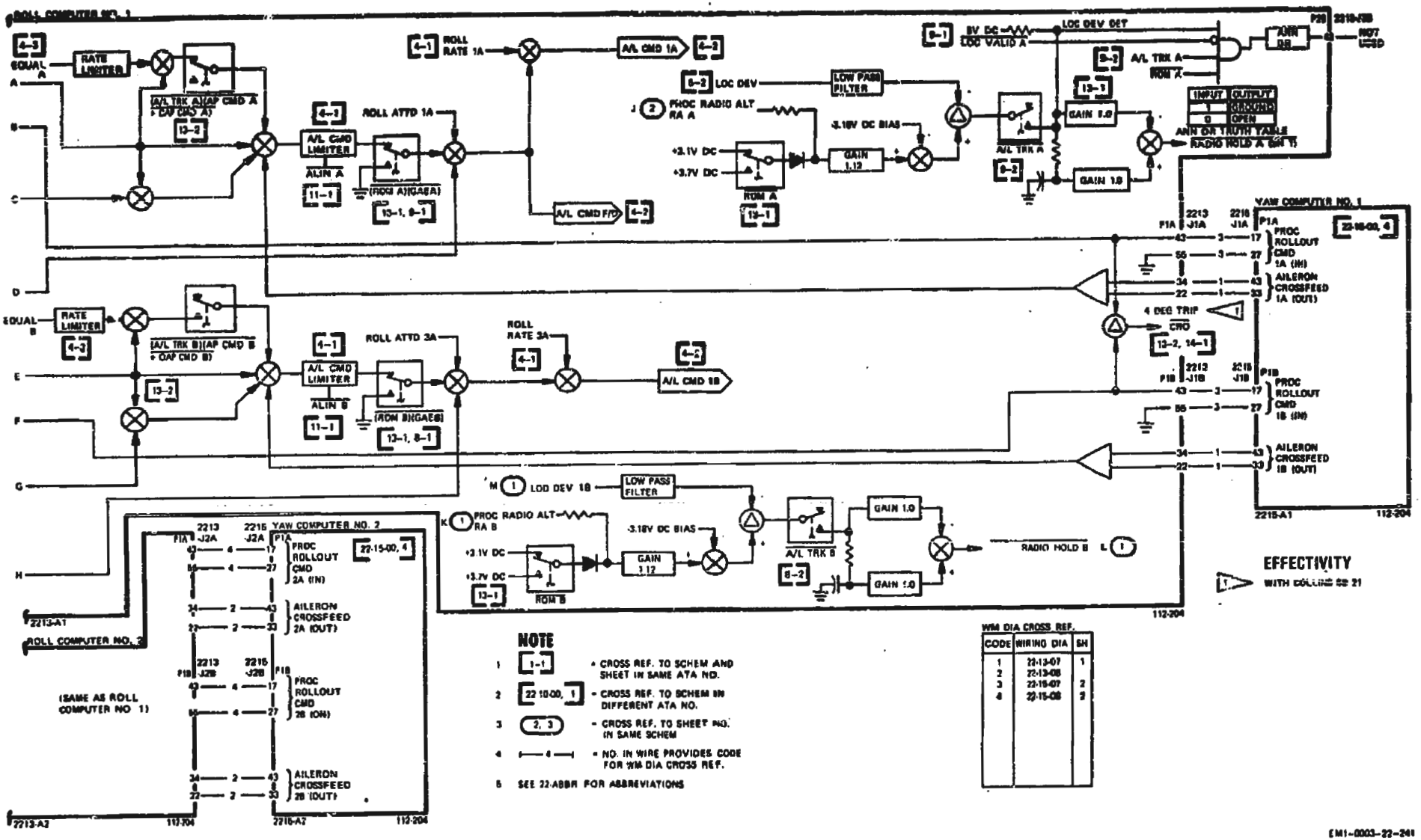
1. [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA CROSS REF.

CODE	WIRING DIA.	SH
1	22-11-09	1
2	22-11-10	1
3	22-11-09	2
4	22-11-10	2
5	22-13-01	
6	22-13-02	
7	22-13-05	3
8	22-13-06	3
9	22-13-07	1
10	22-13-08	
11	22-17-07	3

Roll Systems No. 1 and No. 2 AUTOLAND Mode Signal Flow Schematic
SCHEM 6 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



NOTE

1. [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4. 4 — 4 - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

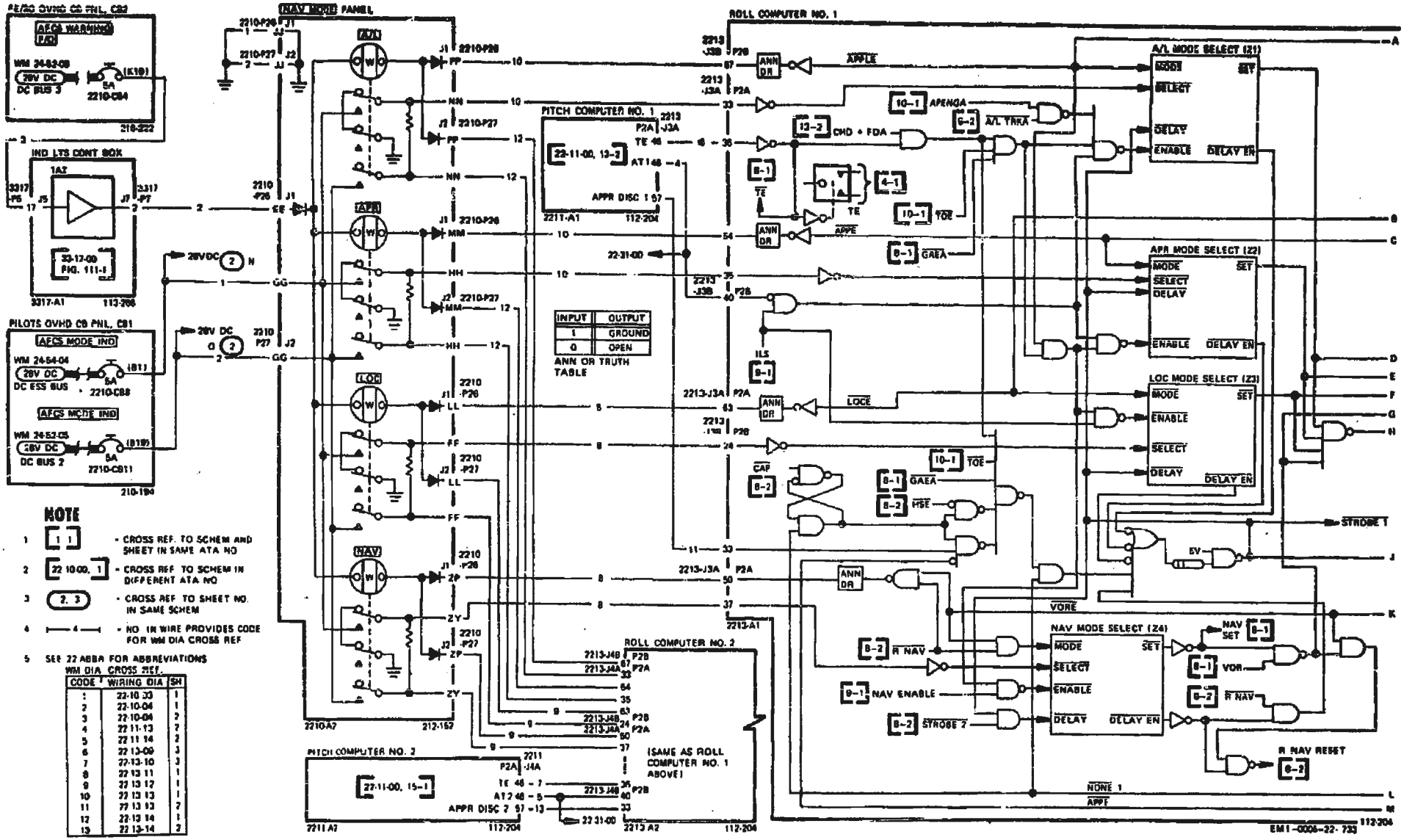
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-13-07	1
2	22-13-08	
3	22-15-07	2
4	22-15-08	2

EM1-0003-22-241

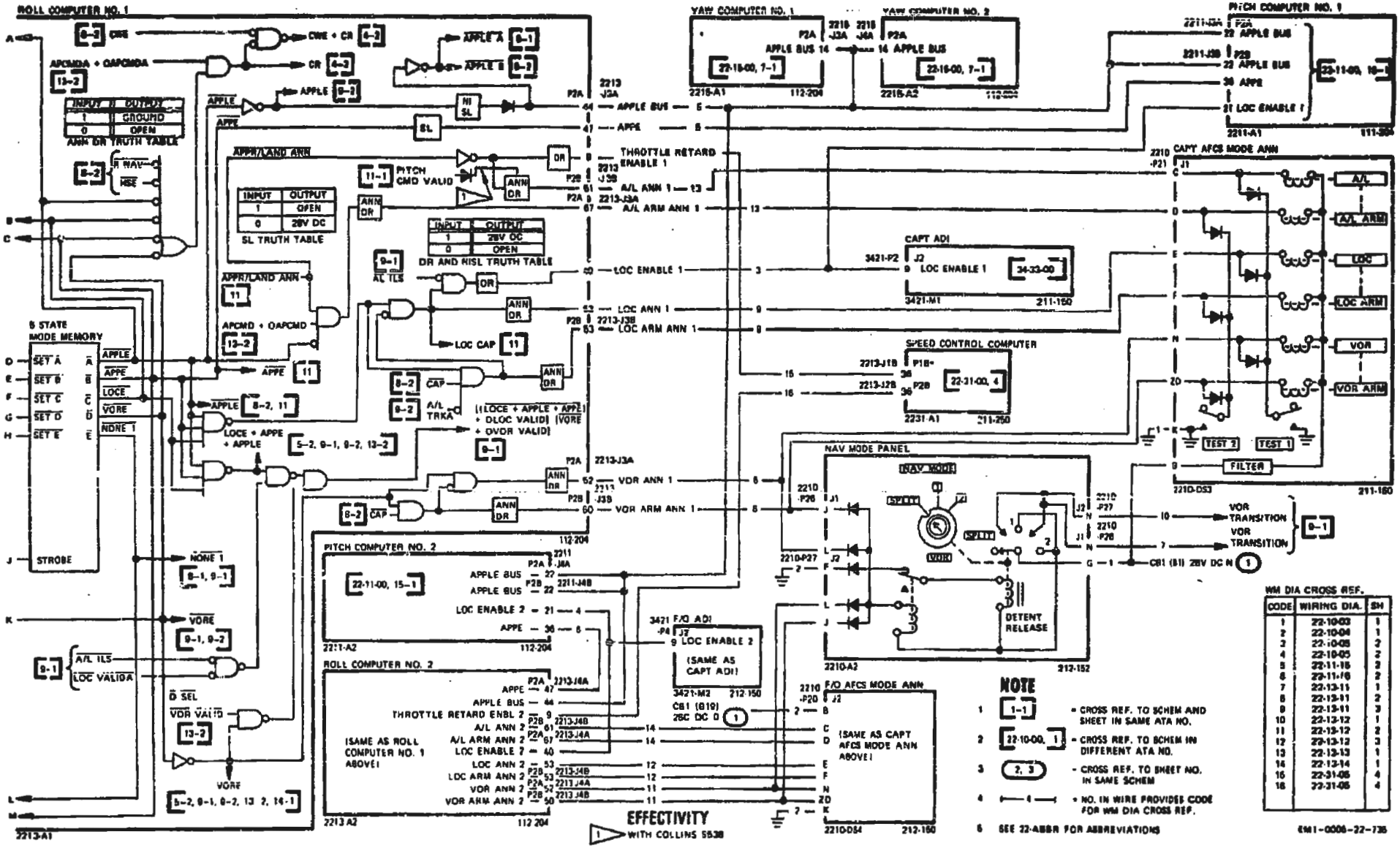
Roll Systems No. 1 and No. 2 AUTOLAND Mode Signal Flow Schematic
SCHEM 6 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic
SCHEM 7 (Sheet 1)

R EFFECTIVITY: ALL
R
001B

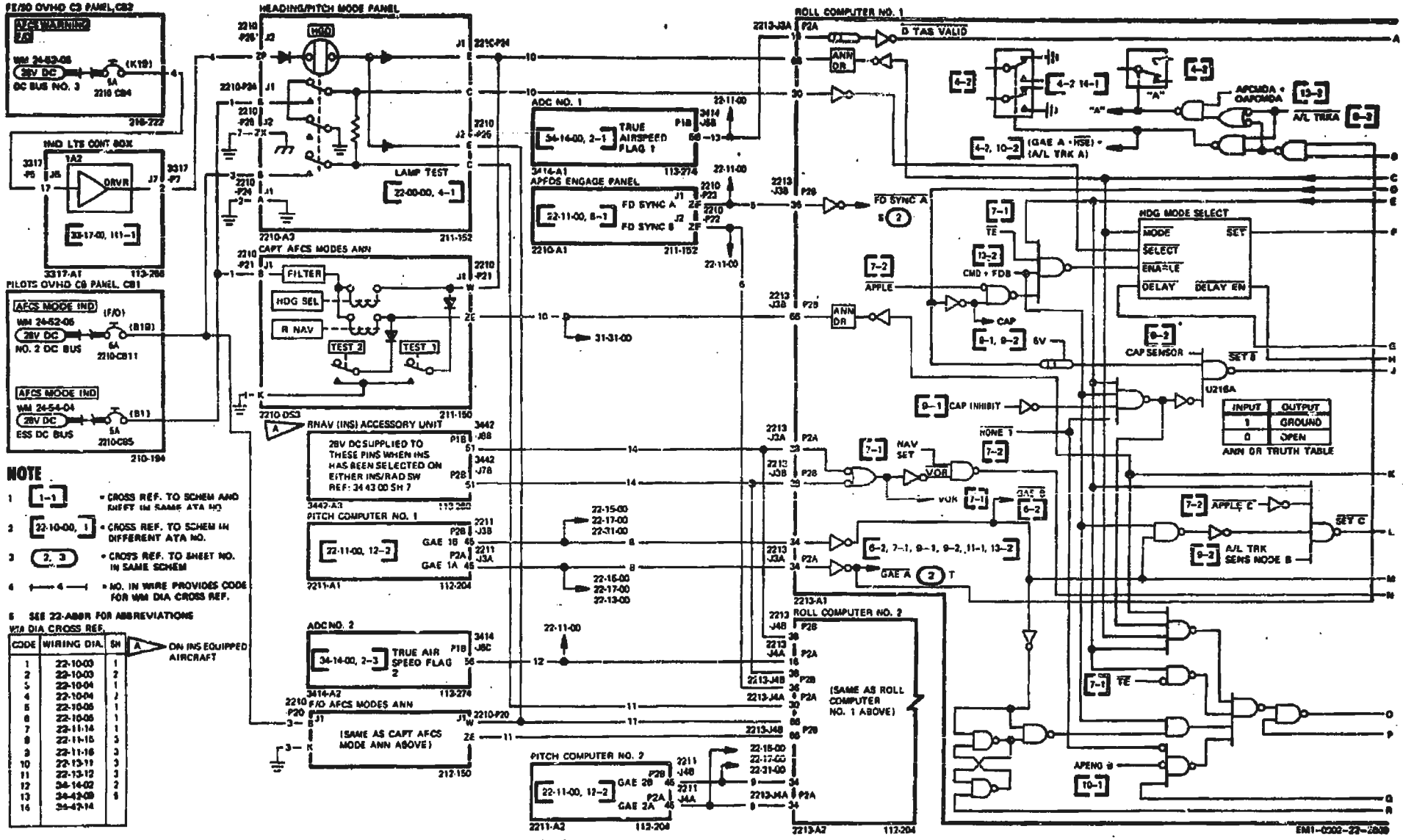


A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic
SCHEM 7 (Sheet 2)

EFFECTIVITY: ALL

22-13-00
Page 131/132
Mar 15/91

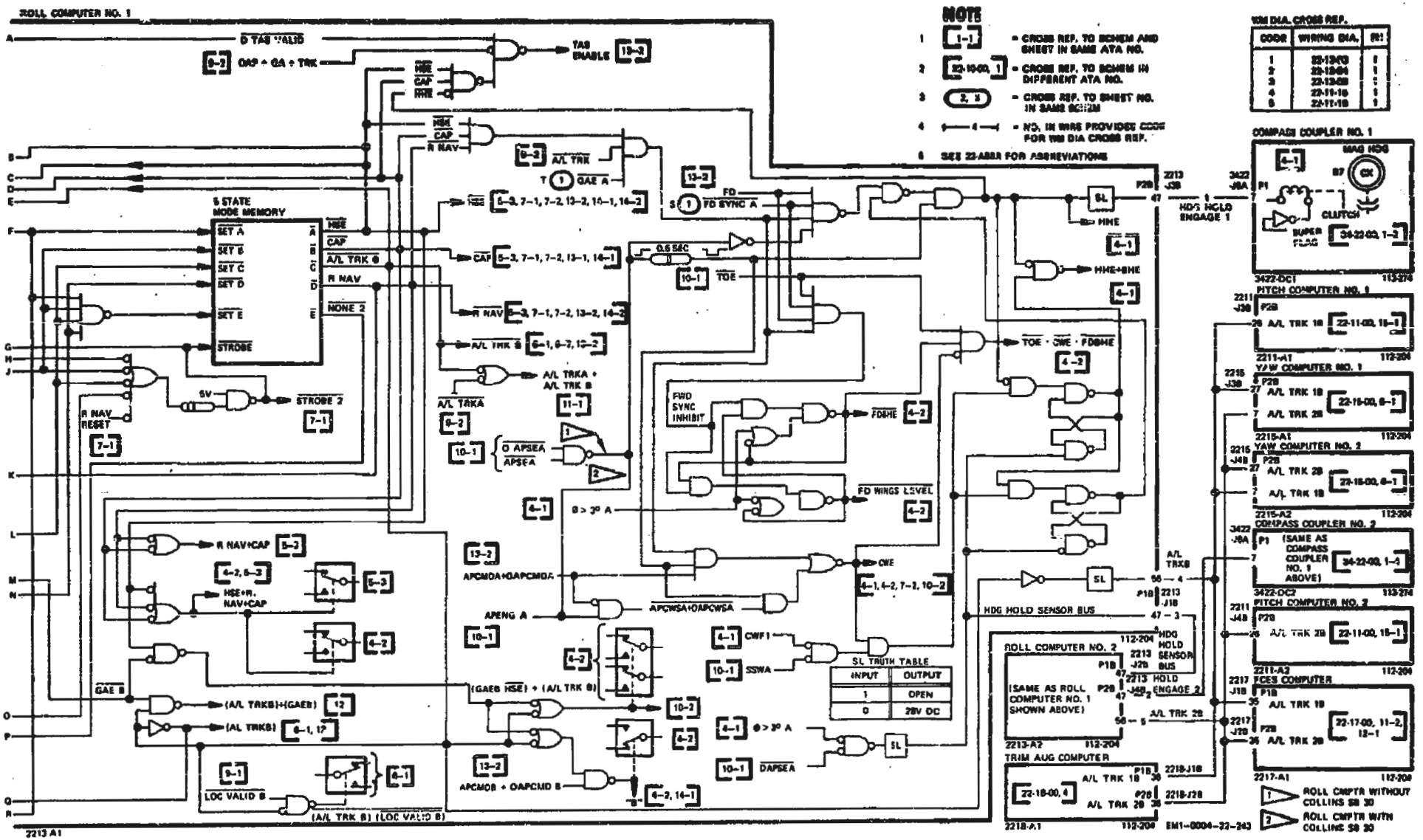
001B



HDG SEL, HDG HOLD, Capture, A/L TRK-B and R-NAV Mode Engage (Exclusive Mode) Logic Schematic
SCHEM 8 (Sheet 1)

EFFECTIVITY: ALL

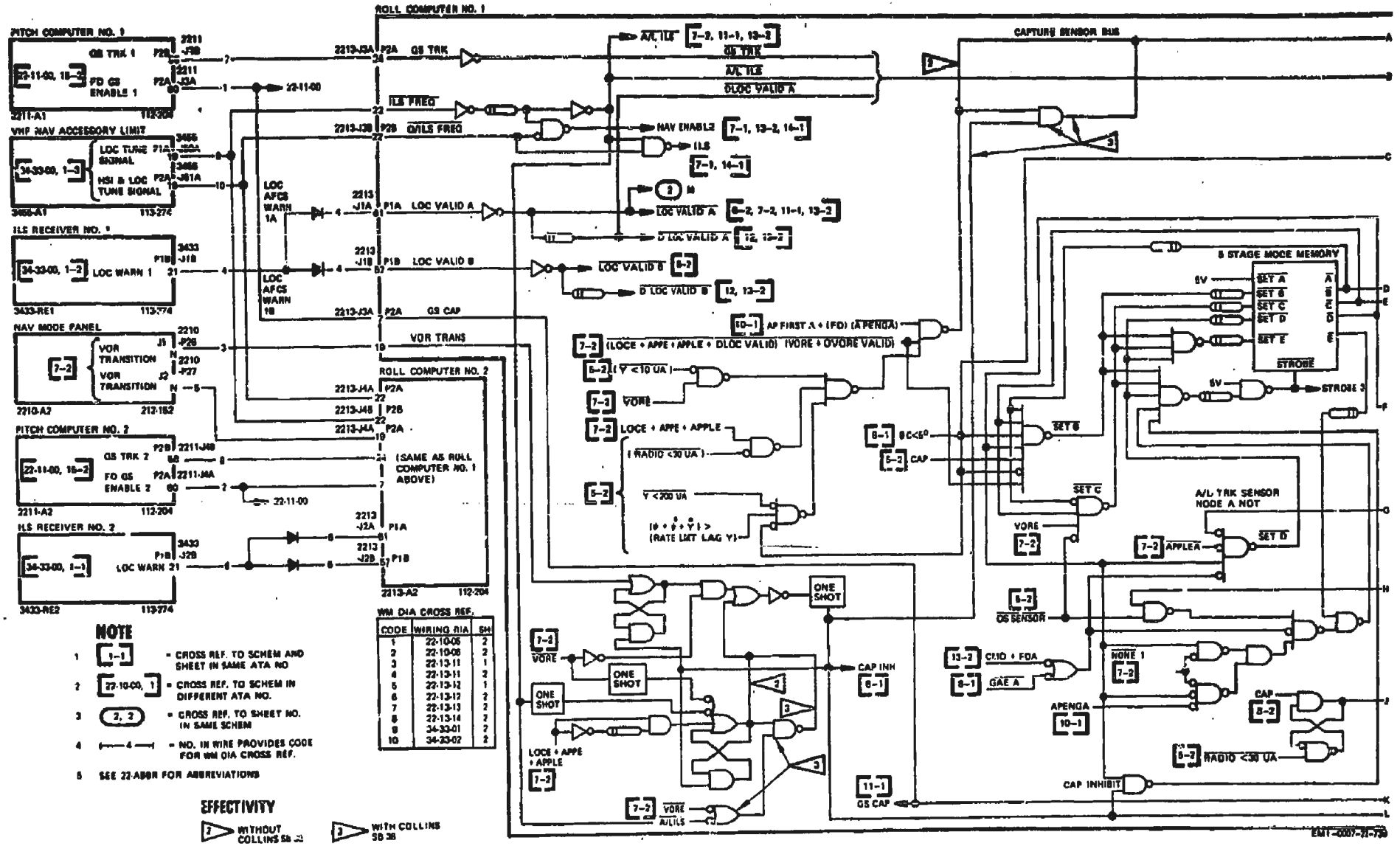
001B



HDG SEL, HDG Hold, Capture, A/L TRK-B and R-NAV Mode Engage
(Exclusive Mode) Logic Schematic
SCHEM 8 (Sheet 2)

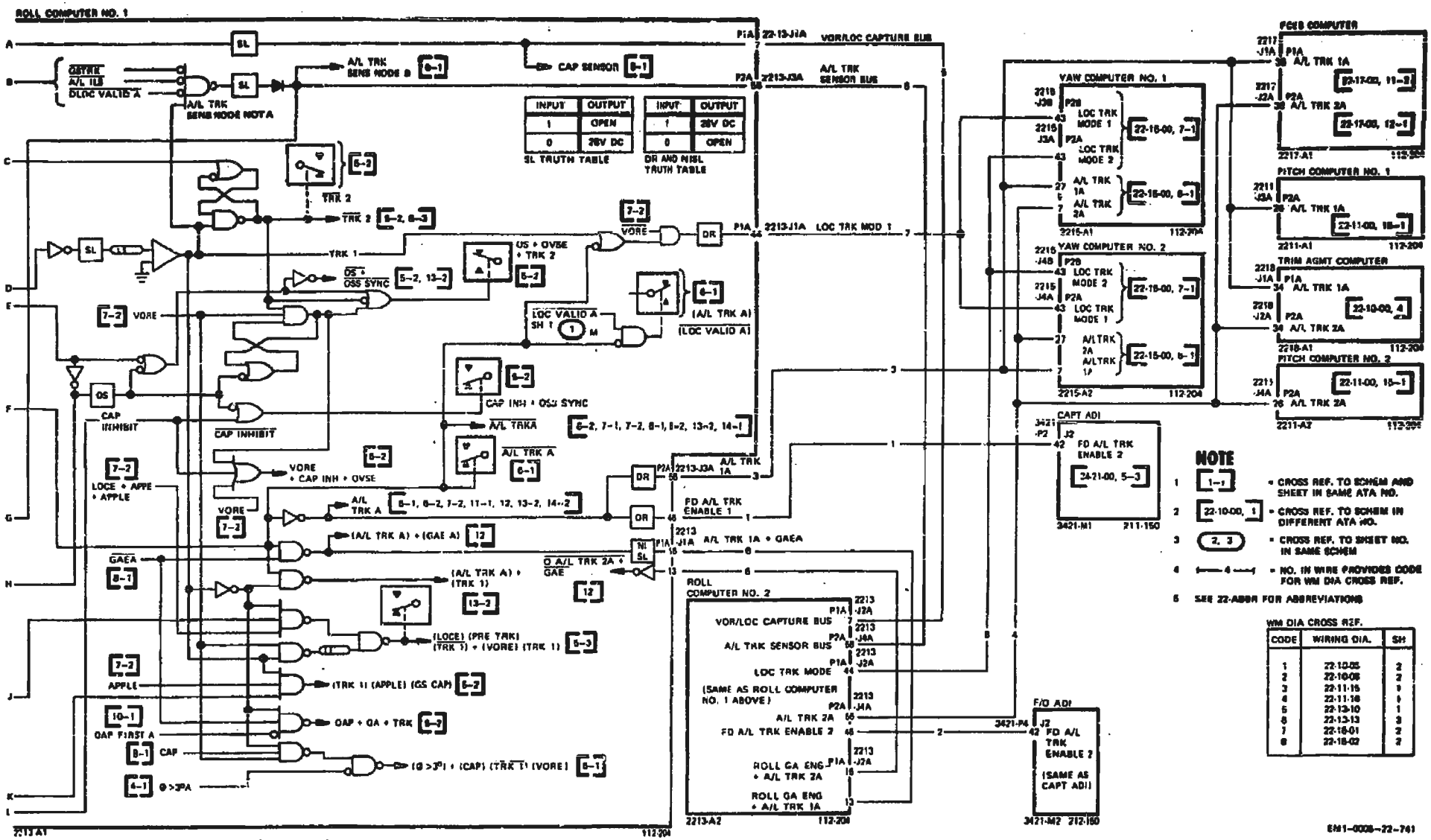
EFFECTIVITY: ALL

R
R
001B


ROLL COMPUTER NO. 1
PITCH COMPUTER NO. 1
VHF NAV ACCESSORY UNIT
ILS RECEIVER NO. 1
NAV MODE PANEL
PITCH COMPUTER NO. 2
ILS RECEIVER NO. 2
ROLL COMPUTER NO. 2
CAPTURE SENSOR BUS
8 STAGE MODE MEMORY
A/L TRK SENSOR NODE A NOT
WH DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-10-05 | 2
2 | 22-10-06 | 2
3 | 22-13-11 | 1
4 | 22-13-11 | 2
5 | 22-13-12 | 1
6 | 22-13-12 | 2
7 | 22-13-13 | 2
8 | 22-13-14 | 2
9 | 34-33-01 | 2
10 | 34-33-02 | 2
NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 2) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 ⟵4⟶ = NO. IN WIRE PROVIDES CODE FOR WH DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
EFFECTIVITY
2 WITHOUT COLLINS SB 31
3 WITH COLLINS SB 31

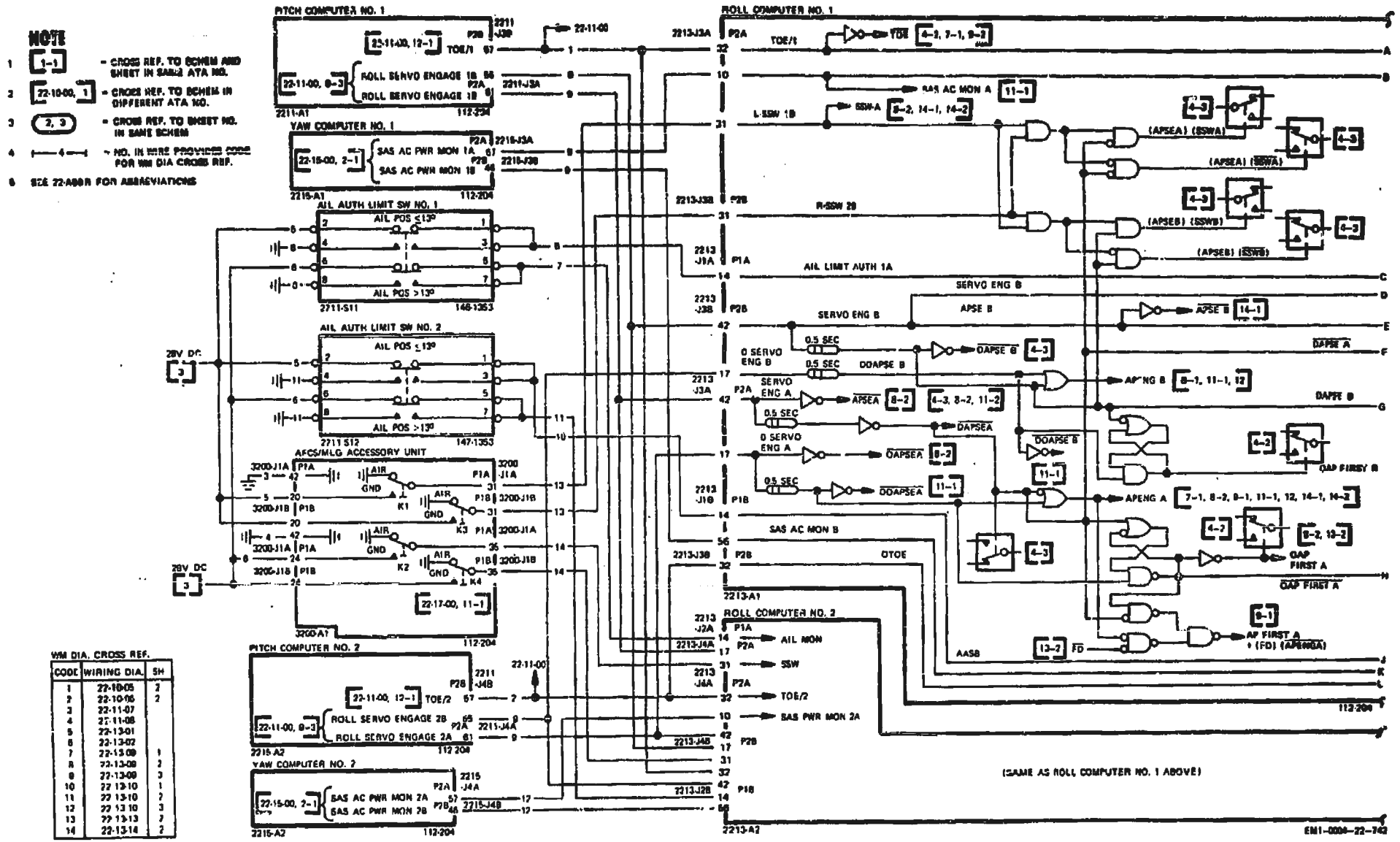
A/L TRK A, TRK 1, VOR/LOC Capture, OS and LOC TRK
Mode Engage Logic Schematic
SCHEM 9 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



A/L TRK A, TRK 1, VOR/LOC Capture, OS and LOC TRK Mode Engage Logic Schematic
SCHEM 9 (Sheet 2)

EFFECTIVITY: ALL

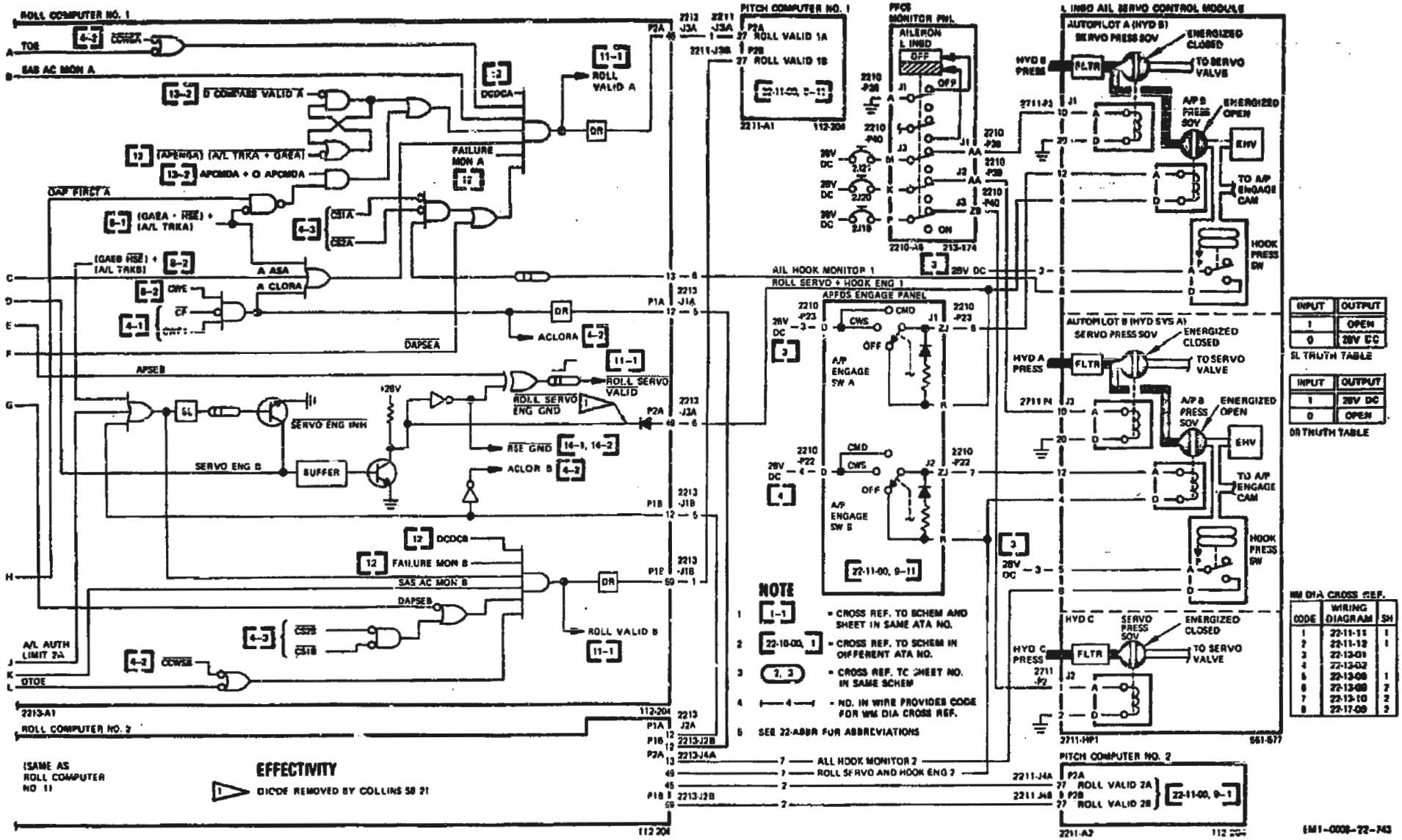


WM DIA. CROSS REF.

CODE	WIRING DIA.	SH
1	22-10-05	2
2	22-10-06	2
3	22-11-07	
4	22-11-08	
5	22-13-01	
6	22-13-02	
7	22-13-09	1
8	22-13-09	2
9	22-13-09	3
10	22-13-10	1
11	22-13-10	2
12	22-13-10	3
13	22-13-13	2
14	22-13-14	2

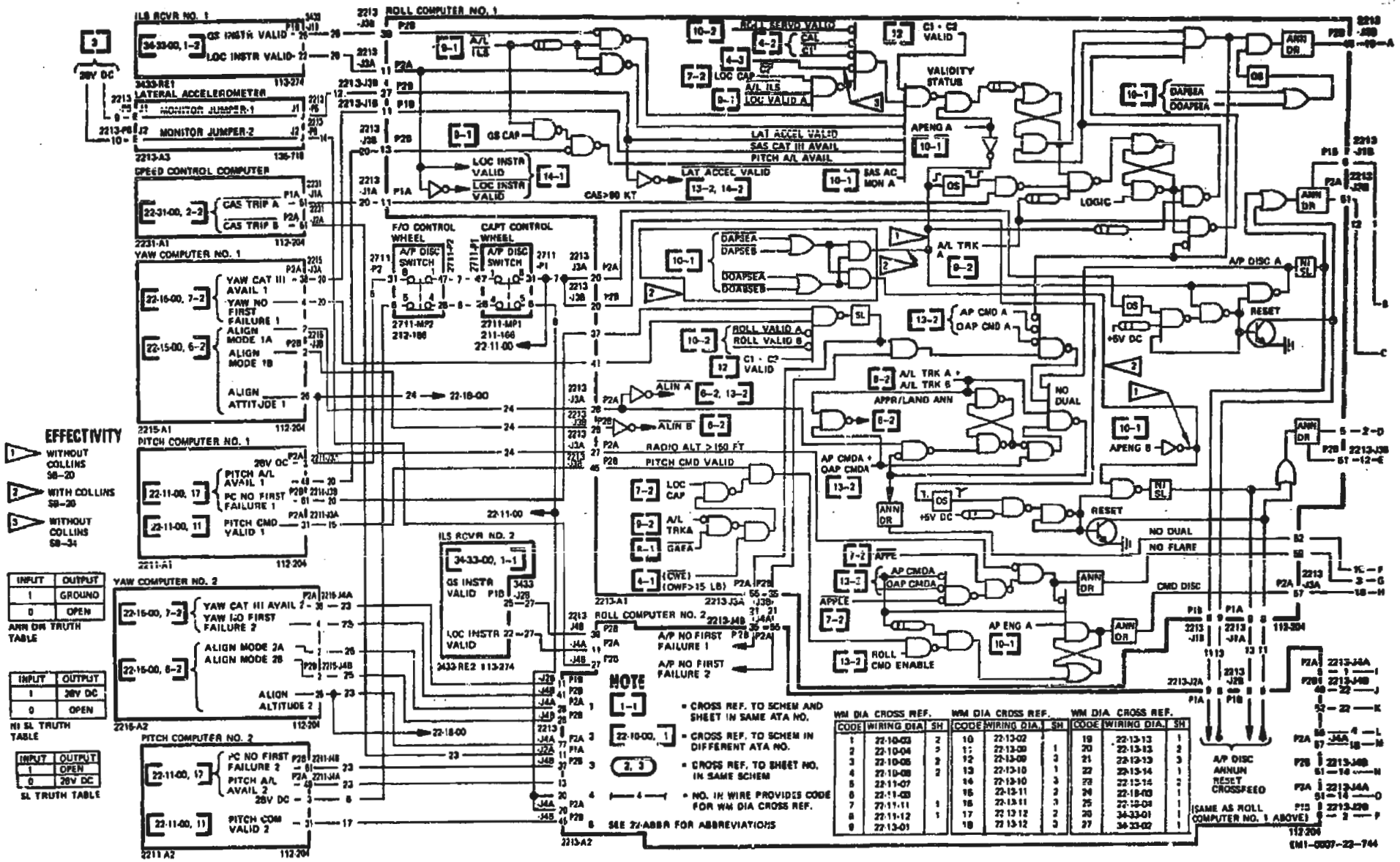
Roll Servo Engage/Valid and Roll Valid Logic Schematic
SCHEM 10 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



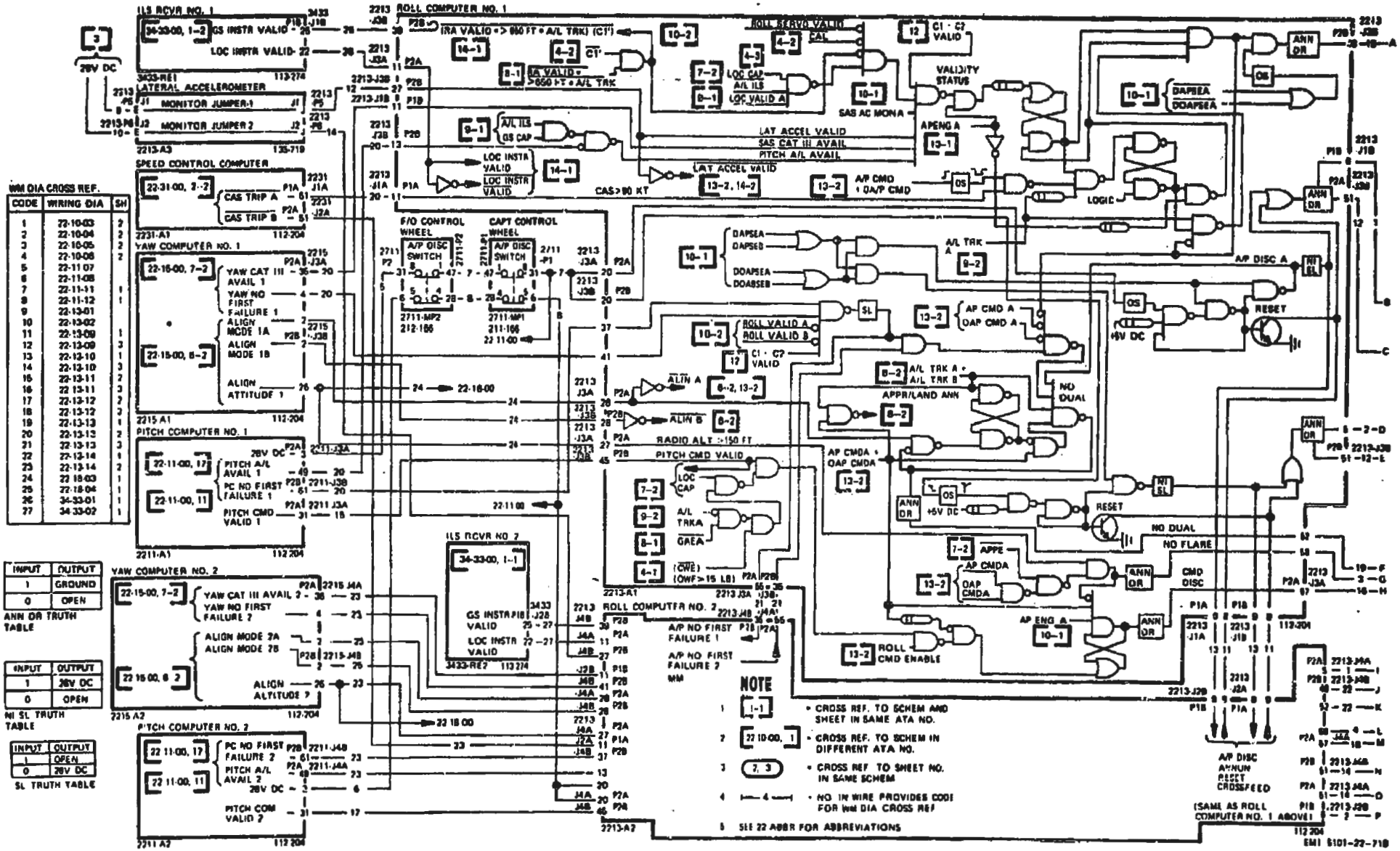
Roll Servo Engage/Valid and Roll Valid Logic Schematic
SCHEM 10 (Sheet 2)

R
R
001B EFFECTIVITY: ALL



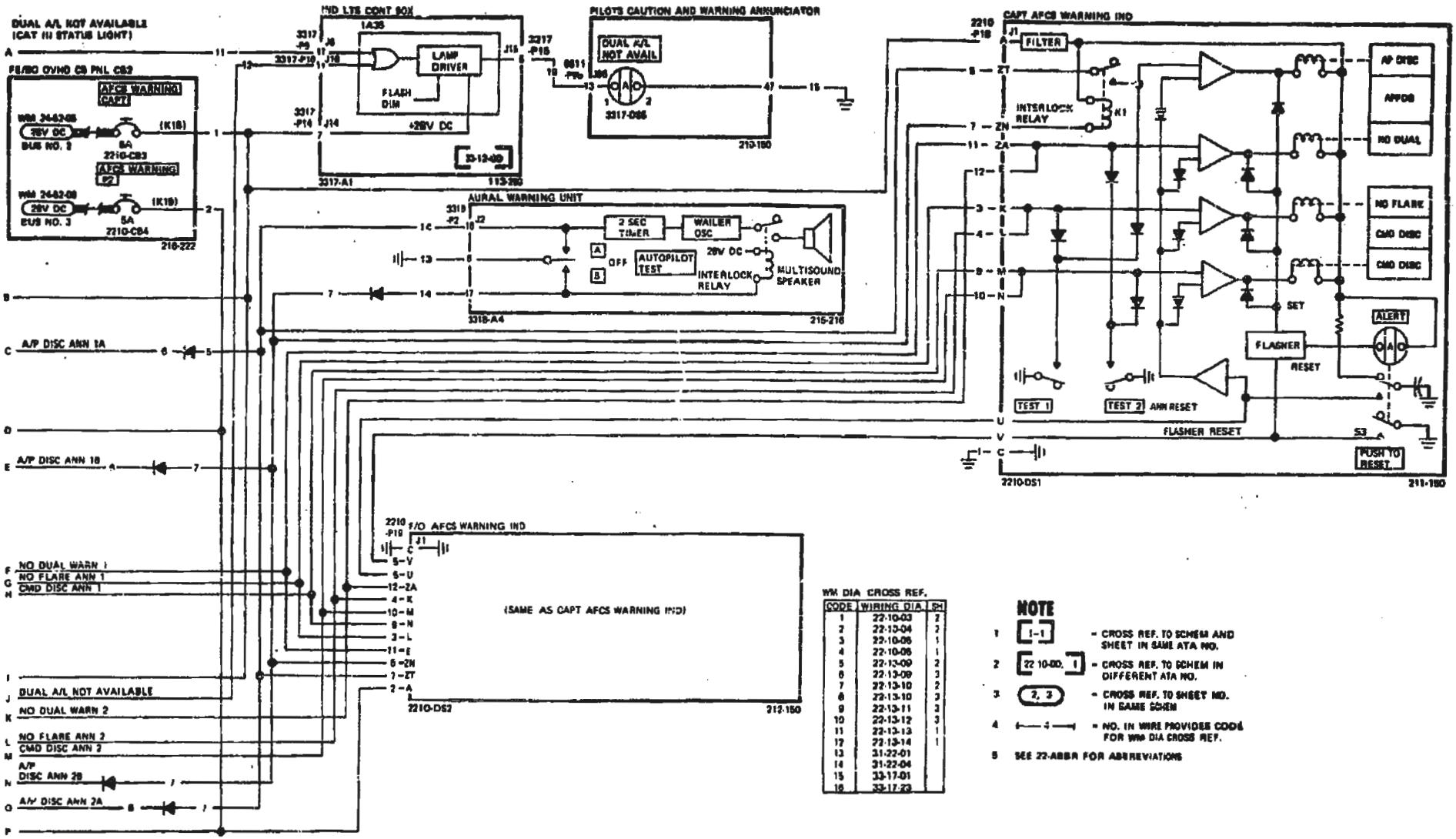
A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic
SCHEM 11 (Sheet 1)

R EFFECTIVITY: WITHOUT COLLINS SB38
R
0018



A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic
SCHEM 11 (Sheet 1)

R EFFECTIVITY: WITH COLLINS SB38
R
001B



WIR DIA CROSS REF.

CODE	WIRING DIA	GA
1	22-10-03	2
2	22-13-04	2
3	22-10-06	1
4	22-10-06	1
5	22-13-09	2
6	22-13-09	2
7	22-13-10	2
8	22-13-10	2
9	22-13-11	2
10	22-13-12	2
11	22-13-13	1
12	22-13-14	1
13	31-22-01	
14	31-22-04	
15	33-17-01	
16	33-17-23	

NOTE

1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

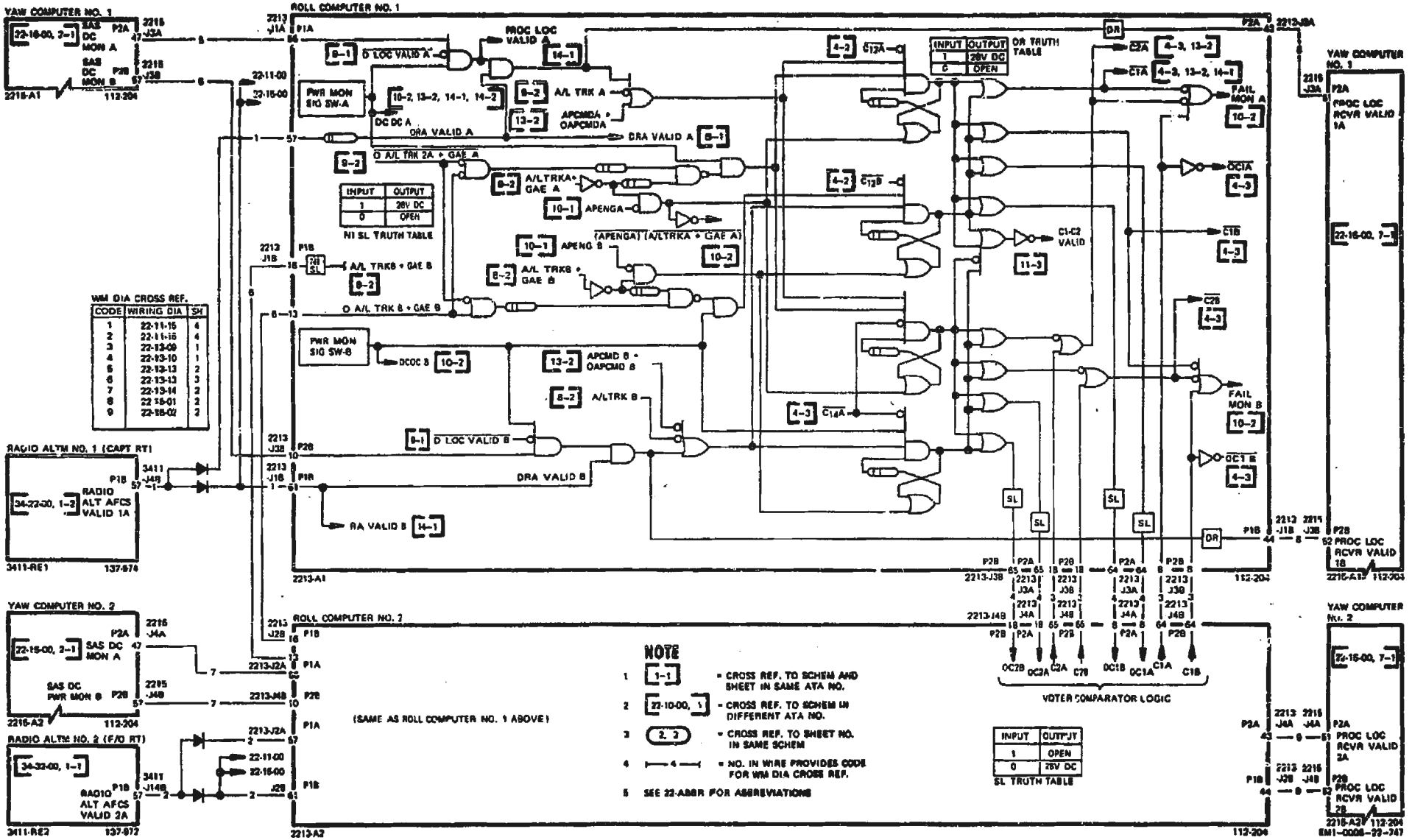
2 [22 10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM

4 —4— = NO. IN WIRE PROVIDES CODE FOR WIR DIA CROSS REF.

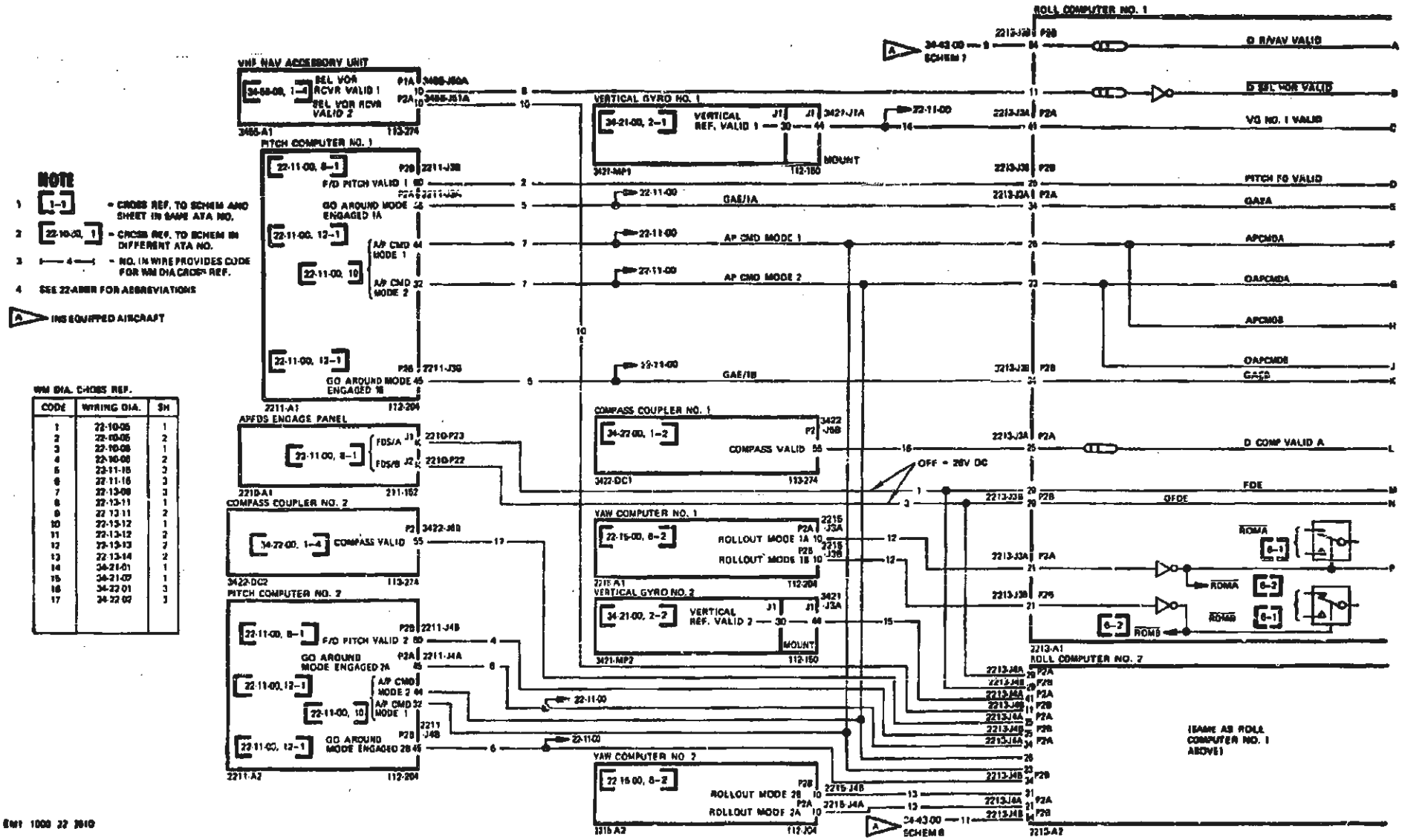
5 SEE 22-ABBR FOR ABBREVIATIONS

A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic
SCHEM 11 (Sheet 2)


YAW COMPUTER NO. 1
ROLL COMPUTER NO. 1
YAW COMPUTER NO. 2
ROLL COMPUTER NO. 2
RADIO ALTM NO. 1 (CAPT RT)
RADIO ALTM NO. 2 (F/O RT)
PROC LOC VALID A
D LOC VALID A
DRA VALID A
A/L TRK A
A/L TRK A • GAE A
APENGA
APENG B
A/L TRK B • GAE B
D A/L TRK A • GAE A
D A/L TRK B • GAE B
PWR MON SIG SW-A
PWR MON SIG SW-B
DCOC A
DCOC B
APCMD A • OAPCMD A
APCMD B • OAPCMD B
A/LTRK A
A/LTRK B
D LOC VALID B
DRA VALID B
RA VALID B
NI SL TRUTH TABLE
WM DIA CROSS REF.
OR TRUTH TABLE
C1-C2 VALID
FAIL MON A
FAIL MON B
PROC LOC RCVR VALID 1A
PROC LOC RCVR VALID 1B
PROC LOC RCVR VALID 2A
PROC LOC RCVR VALID 2B
VOTER COMPARATOR LOGIC
SL TRUTH TABLE
NOTE
1 1-1 = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 22-10-00, 1 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 2, 3 = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
(SAME AS ROLL COMPUTER NO. 1 ABOVE)

Roll Voter Switching and Valid Processing Logic Schematic
SCHEM 12

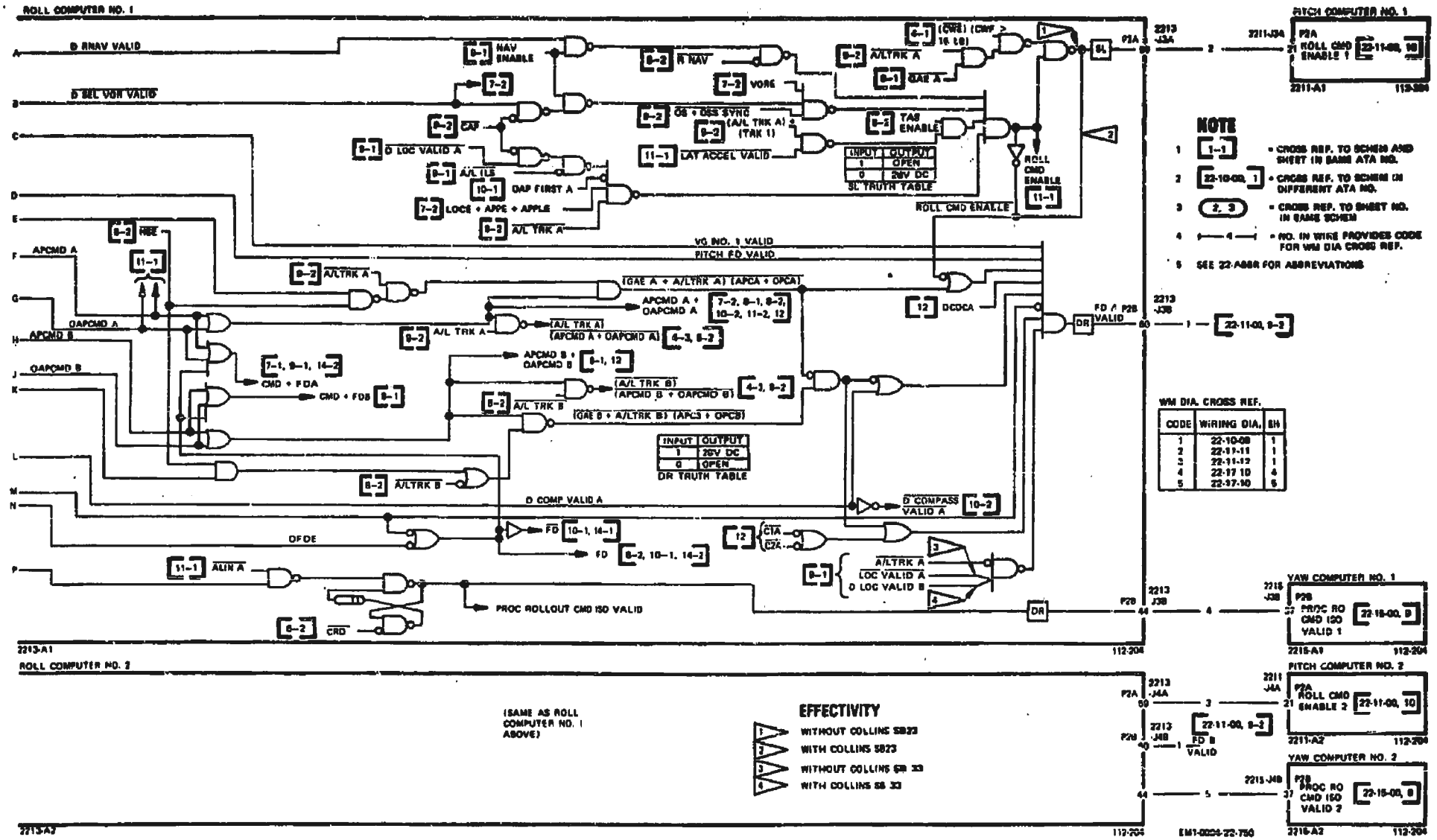
R EFFECTIVITY: ALL
R
001B


NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-03, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
4 SEE 22-ABBR FOR ABBREVIATIONS
A INS EQUIPPED AIRCRAFT
WM DIA. CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-10-05 | 1
2 | 22-10-05 | 2
3 | 22-10-08 | 1
4 | 22-10-08 | 2
5 | 22-11-15 | 3
6 | 22-11-16 | 3
7 | 22-13-09 | 3
8 | 22-13-11 | 1
9 | 22 13 11 | 2
10 | 22-13-12 | 1
11 | 22-13-12 | 2
12 | 22-13-13 | 2
13 | 22-13-14 | 2
14 | 34-21-01 | 1
15 | 34-21-07 | 1
16 | 34-22 01 | 3
17 | 34-22 02 | 3
VHF NAV ACCESSORY UNIT
REL VOR RCVR VALID 1
REL VOR RCVR VALID 2
PITCH COMPUTER NO. 1
F/D PITCH VALID 1
GO AROUND MODE ENGAGED 1A
A/P CMD MODE 1
A/P CMD MODE 2
GO AROUND MODE ENGAGED 1B
APFDS ENGAGE PANEL
FDS/A
FDS/B
COMPASS COUPLER NO. 2
COMPASS VALID
PITCH COMPUTER NO. 2
F/D PITCH VALID 2
GO AROUND MODE ENGAGED 2A
A/P CMD MODE 2
A/P CMD MODE 1
GO AROUND MODE ENGAGED 2B
VERTICAL GYRO NO. 1
VERTICAL REF. VALID 1
MOUNT
COMPASS COUPLER NO. 1
COMPASS VALID
YAW COMPUTER NO. 1
ROLLOUT MODE 1A
ROLLOUT MODE 1B
VERTICAL GYRO NO. 2
VERTICAL REF. VALID 2
YAW COMPUTER NO. 2
ROLLOUT MODE 2B
ROLLOUT MODE 2A
ROLL COMPUTER NO. 1
D R/NAV VALID
D SEL VOR VALID
VG NO. 1 VALID
PITCH FD VALID
GA2A
APCMDA
GAPCMDA
APCMDB
GAPCMDB
GA2B
D COMP VALID A
OFF = 28V DC
FDE
GFDE
ROMA
ROMB
ROLL COMPUTER NO. 2
(SAME AS ROLL COMPUTER NO. 1 ABOVE)
SCHEM 7
SCHEM 8

EM1 1000 22 3810

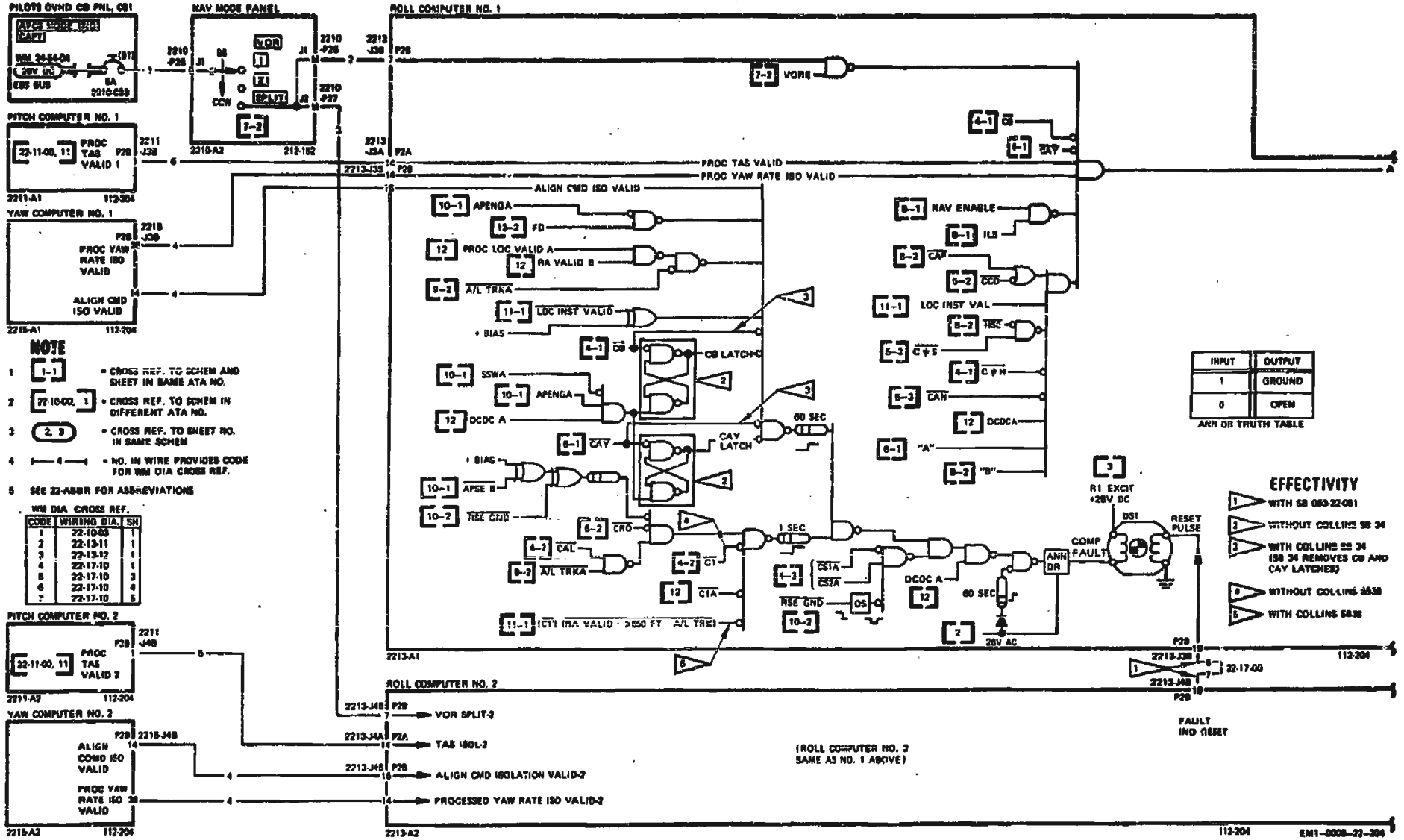
C Roll Command and FD Valid Logic Schematic
C SCHEM 13 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



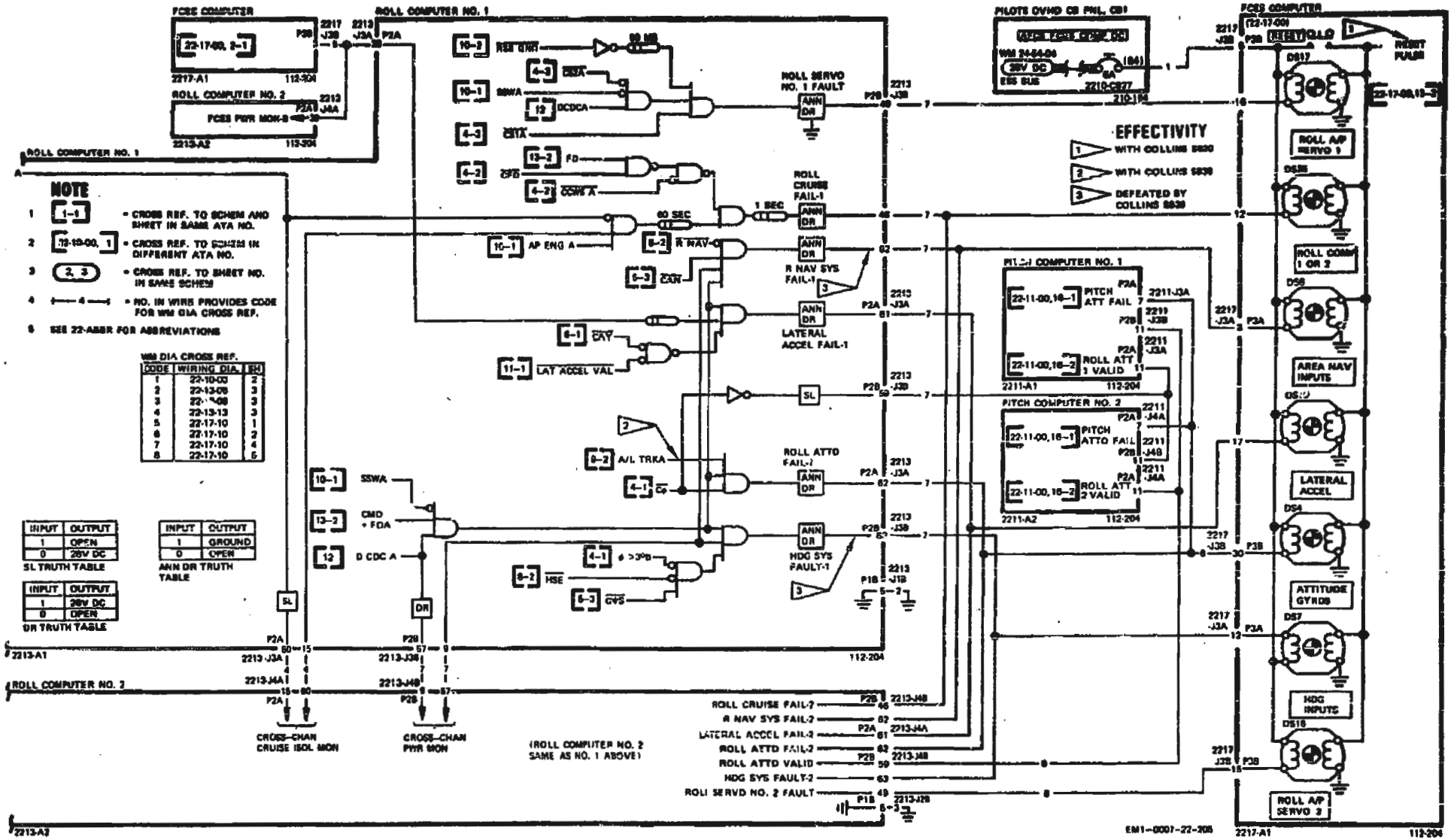
Roll Command Enable and FD Valid Logic Schematic
SCHEM 13 (Sheet 2)

R
R
0018 EFFECTIVITY: ALL


PILOTS OVHD CB PNL, CB1
NAV MODE PANEL
ROLL COMPUTER NO. 1
PITCH COMPUTER NO. 1
YAW COMPUTER NO. 1
PROC TAS VALID 1
PROC YAW RATE ISO VALID
ALIGN CMD ISO VALID
PROC LOC VALID A
RA VALID B
A/L TRKA
LOC INST VALID
+ BIAS
SSWA
APENGA
DCDC A
CAV LATCH
60 SEC
APSE B
RSE GND
1 SEC
ICTI (RA VALID > 550 FT A/L TRK)
NAV ENABLE
ILS
LOC INST VAL
"A"
"B"
R1 EXCIT +28V DC
COMP FAULT
RESET PULSE
ANN DR
28V AC
PITCH COMPUTER NO. 2
YAW COMPUTER NO. 2
ROLL COMPUTER NO. 2
VOR SPLIT-2
TAS ISOL-2
ALIGN CMD ISOLATION VALID-2
PROCESSED YAW RATE ISO VALID-2
(ROLL COMPUTER NO. 2 SAME AS NO. 1 ABOVE)
FAULT IND RESET
NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-10-00 | 1
2 | 22-13-11 | 1
3 | 22-13-12 | 1
4 | 22-17-10 | 1
5 | 22-17-10 | 3
6 | 22-17-10 | 4
7 | 22-17-10 | 5
INPUT | OUTPUT
1 | GROUND
0 | OPEN
ANN DR TRUTH TABLE
EFFECTIVITY
1 WITH SB 093-22-061
2 WITHOUT COLLINS SB 34
3 WITH COLLINS SB 34 (SB 34 REMOVES CB AND CAV LATCHES)
4 WITHOUT COLLINS SB 38
5 WITH COLLINS SB 38

Roll FIM Schematic
SCHEM 14 (Sheet 1)

R EFFECTIVITY: ALL
R
0018


FCSE COMPUTER
ROLL COMPUTER NO. 1
ROLL COMPUTER NO. 2
PILOTS OVHD CB PNL, CB1
FCSE COMPUTER
ROLL SERVO NO. 1 FAULT
ROLL CRUISE FAIL-1
R NAV SYS FAIL-1
LATERAL ACCEL FAIL-1
ROLL ATTD FAIL-1
HDG SYS FAULT-1
EFFECTIVITY
1 WITH COLLINS 6830
2 WITH COLLINS 6830
3 DEFEATED BY COLLINS 6830
NOTE
1 CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 CROSS REF. TO SHEET NO. IN SAME SCHEM
4 NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-10-03 | 2
2 | 22-13-05 | 3
3 | 22-13-08 | 3
4 | 22-13-13 | 3
5 | 22-17-10 | 1
6 | 22-17-10 | 2
7 | 22-17-10 | 4
8 | 22-17-10 | 6
SL TRUTH TABLE
INPUT | OUTPUT
1 | OPEN
0 | 28V DC
ANN DR TRUTH TABLE
INPUT | OUTPUT
1 | GROUND
0 | OPEN
DR TRUTH TABLE
INPUT | OUTPUT
1 | 28V DC
0 | OPEN
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
PITCH ATT FAIL
ROLL ATT 1 VALID
PITCH ATTD FAIL
ROLL ATT 2 VALID
ROLL SERVO NO. 2 FAULT
ROLL ATTD VALID
CROSS-CHAN CRUISE ISOL MON
CROSS-CHAN PWR MON
(ROLL COMPUTER NO. 2 SAME AS NO. 1 ABOVE)
ROLL A/P SERVO 1
ROLL COMM 1 OR 2
AREA NAV INPUTS
LATERAL ACCEL
ATTITUDE GYROS
HDG INPUTS
ROLL A/P SERVO 2

Roll FIM Schematic
SCHEM 14 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

ROLL COMPUTER - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following applicable circuit breakers:

(a) For roll computer No. 1:

R AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - PITCH & ROLL (A6)

R AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND R (B1)

R (b) For roll computer No. 2:

R AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - R PITCH & ROLL (A24)

R AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND R (B19)

R On Flight Engineer/Second Officers overhead circuit R breaker panel CB2, zone 215, open and tag circuit R breakers AFCS WARNING - CAPT (K18) and AFCS WARNING - R F/O (K19).

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate roll computer in center rack (Ref. Fig. 401).

(3) Release holddowns on computer front panel.

(4) Pull computer handle to release computer electrical connectors from mount connectors.

(5) Slide computer out of mount.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Slide computer (Ref. Fig. 401) into mount until computer electrical connectors mate with mount connectors.

(3) Secure computer with holddowns.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Perform Operational test in Step C.

C. Operational Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic systems A, B, C and D (Reference 29-11-00).

R On aircraft with INS,
R When ATT flags on both ADIs go out of view and VERTICAL
R GYRO 3 legend goes out, the FD and autopilot can be
R engaged.

WARNING: DO NOT ENGAGE AUTOPILOT IF THE AIRCRAFT IS ON JACKS.

(2) On APFDS ENGAGE panel, set applicable AP switch to CMD.

(3) Move Captains control wheel to right, left, then center.

RESULT:

Control surfaces follow as indicated on SPI.

No warnings or disconnects should be seen.

(4) Repeat Step (3) for First Officers control wheel.

(5) On HEADING/PITCH MODE panel, rotate HEADING knob to aircraft heading.

(6) On HEADING/PITCH MODE panel, depress HDG switchlight to turn on HDG light.

RESULT:

On both AFCS MODES annunciators, HDG SEL messages are displayed.

(7) Set applicable FD switch to ON.

RESULT:

On applicable ADI, FD flag is out of view and command bar is centered and level.

(8) Rotate HEADING knob 10 degrees greater than aircraft heading.

RESULT:

Control wheel should move for right turn.

On applicable ADI, command bar should indicate right roll.

(9) Rotate HEADING knob 10 degrees less than aircraft heading.

RESULT:

Control wheel should move for left turn.

On applicable ADI, command bar should indicate left roll.

(10) Rotate HEADING knob to aircraft heading.

(11) Depress HDG switchlight to turn off HDG light.

RESULT:

On both AFCS MODES annunciators, HDG SEL messages are removed.

(12) Set both VHF NAV frequency selectors to 108.0 MHz.

(13) On NAV MODE panel, depress NAV switchlight to turn on NAV light.

RESULT:

On both AFCS MODES annunciators, VOR ARM messages are displayed.

On applicable ADI, command bars are centered and level.

(14) Depress NAV switchlight to turn off NAV light.

RESULT:

On both AFCS MODES annunciators, VOR ARM messages are removed.

(15) Set both VHF NAV frequency selectors to 108.1 MHz.

(16) On NAV MODE panel, depress LOC switchlight to turn on LOC light.

RESULT:

On both AFCS MODES annunciators, LOC ARM messages are displayed.

On applicable ADI, command bar is centered and level.

(17) On NAV MODE panel, depress APR switchlight to turn on APR light.

RESULT:

LOC light goes out.

On both AFCS MODES annunciators, LOC ARM and GS ARM messages are displayed.

On applicable ADI, command bar is centered and level.

On AFCS WARNING indicator, NO FLARE message is displayed and flashing ALERT light comes on.

(18) On NAV MODE panel, depress A/L switchlight to turn on A/L light.

RESULT:

APR light goes out.

On both AFCS MODES annunciators, LOC ARM, GS ARM and A/L ARM messages are displayed.

On applicable ADI, command bar is centered and level.

On AFCS WARNING indicator, NO FLARE message is removed, and flashing ALERT goes out.

(19) Depress A/L switchlight to turn off A/L light.

RESULT:

On both AFCS MODES annunciators, messages are removed.

(20) On either control wheel, depress A/P disengage switch.

RESULT:

Applicable AP switch drops to OFF.

On both AFCS WARNING annunciators, AP DISC and flashing ALERT displays come on.

(21) Depress A/P disengage switch.

RESULT:

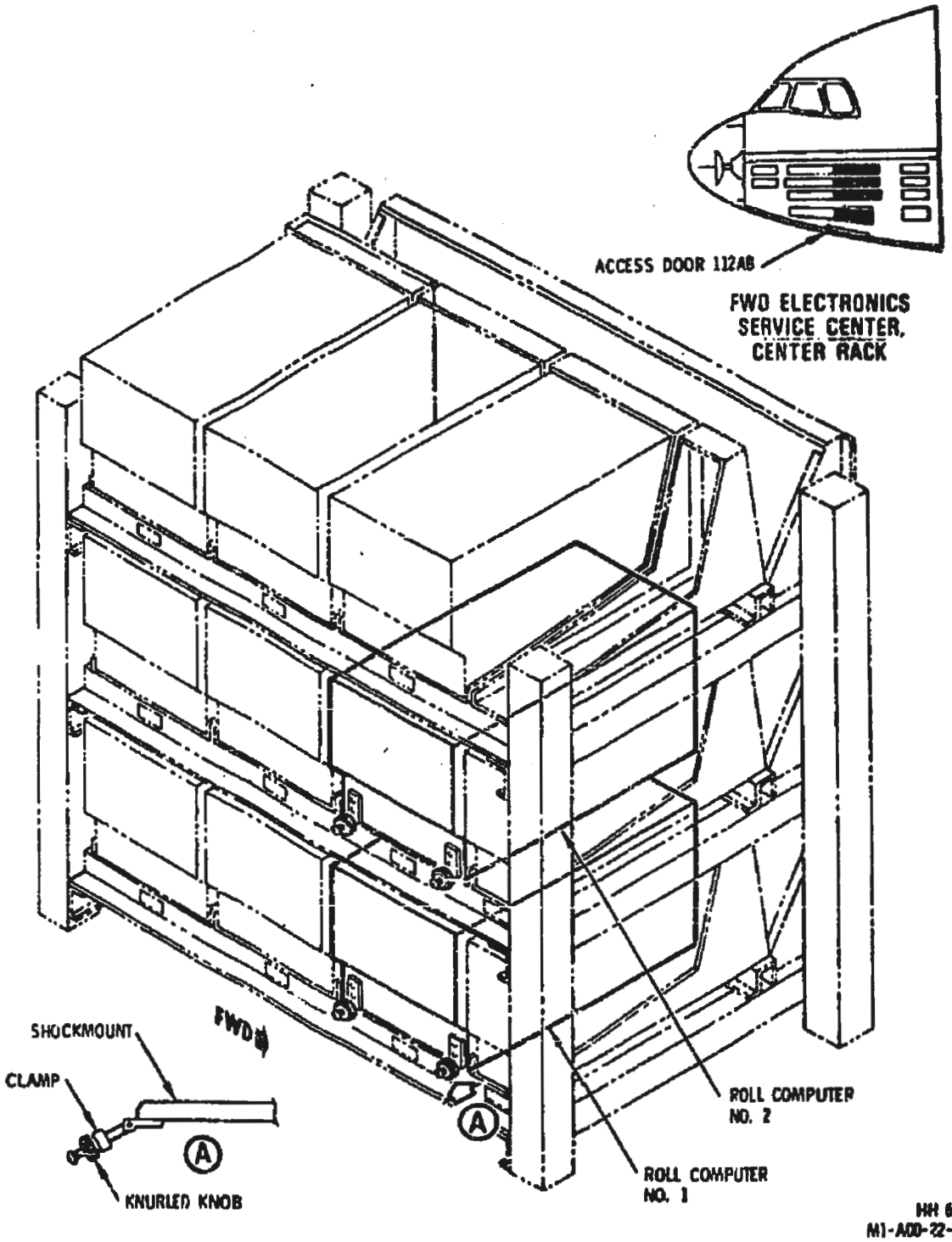
AP DISC and flashing ALERT displays go out.

(22) Set applicable FD switch to OFF.

RESULT:

On applicable ADI, command bar is biased out of view.

(23) Turn off hydraulic systems.



Roll Computer - Removal and Installation
Figure 401

LATERAL ACCELEROMETER UNIT - MAINTENANCE PRACTICES

1. General

The roll lateral accelerometers are deactivated by disconnecting the three electrical connectors from the unit. With the accelerometers disconnected, the autopilot and flight director will operate in all modes, except APR and A/L. The APR and A/L modes are rendered inoperative when the accelerometers are disconnected or removed.

2. Maintenance Practices

A. Deactivation of Lateral Accelerometer

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

NO. 1 SYSTEMS

- PITCH & ROLL (A6)

NO. 2 SYSTEMS

PITCH & ROLL (A24)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker FLIGHT STATION MISC - R AOA (F1).

(2) Open GYROSCOPE ACCESS PANEL in galley ceiling, zone 135.

(3) Disconnect electrical connectors from accelerometer.

(4) Cap and stow electrical connectors and receptacles.

(5) Close GYROSCOPE ACCESS PANEL in galley ceiling.

(6) Close circuit breakers opened in Step (1).

(7) Placard flight station LATERAL ACCELEROMETER DEACTIVATED, NO APR OR A/L AVAILABLE.

(8) Make appropriate entry in aircraft log book.

LATERAL ACCELEROMETER UNIT - REMOVAL AND INSTALLATION

1. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
34-21-00	Attitude Reference System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - PITCH & ROLL (A6)

NO. 2 SYSTEMS - PITCH & ROLL (A24)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker FLIGHT STATION MISC - R AOA (F1).

(2) Open GYROSCOPE ACCESS PANEL in galley ceiling, zone 135.

(3) Disconnect electrical connectors from accelerometer (Ref. Fig. 401).

R (4) Remove mounting screws and remove accelerometer.

B. Installation

The lateral accelerometer installation procedure includes operational test of the accelerometer. The test requires that all other autoflight system components and associated equipment are installed and operational.

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Connect electrical connectors to accelerometer.

(3) Turn on electrical power (Ref. 24-00-00).

(4) Verify that avionics cooling is on (Ref. 21-25-00).

(5) Verify that attitude reference system is on (Ref. 34-21-00).

(6) Remove tags and close circuit breakers opened in Step 2A(1).

(7) On pilots overhead circuit breaker panel CB1, verify that all circuit breakers on AVIONICS FLIGHT CONTROL SYSTEM strips are closed.

(8) On APFDS ENGAGE panel, set both FD switches to ON.

(9) On either control wheel, momentarily depress GO AROUND switch. TAKEOFF message is displayed on both AFCS MODES annunciators.

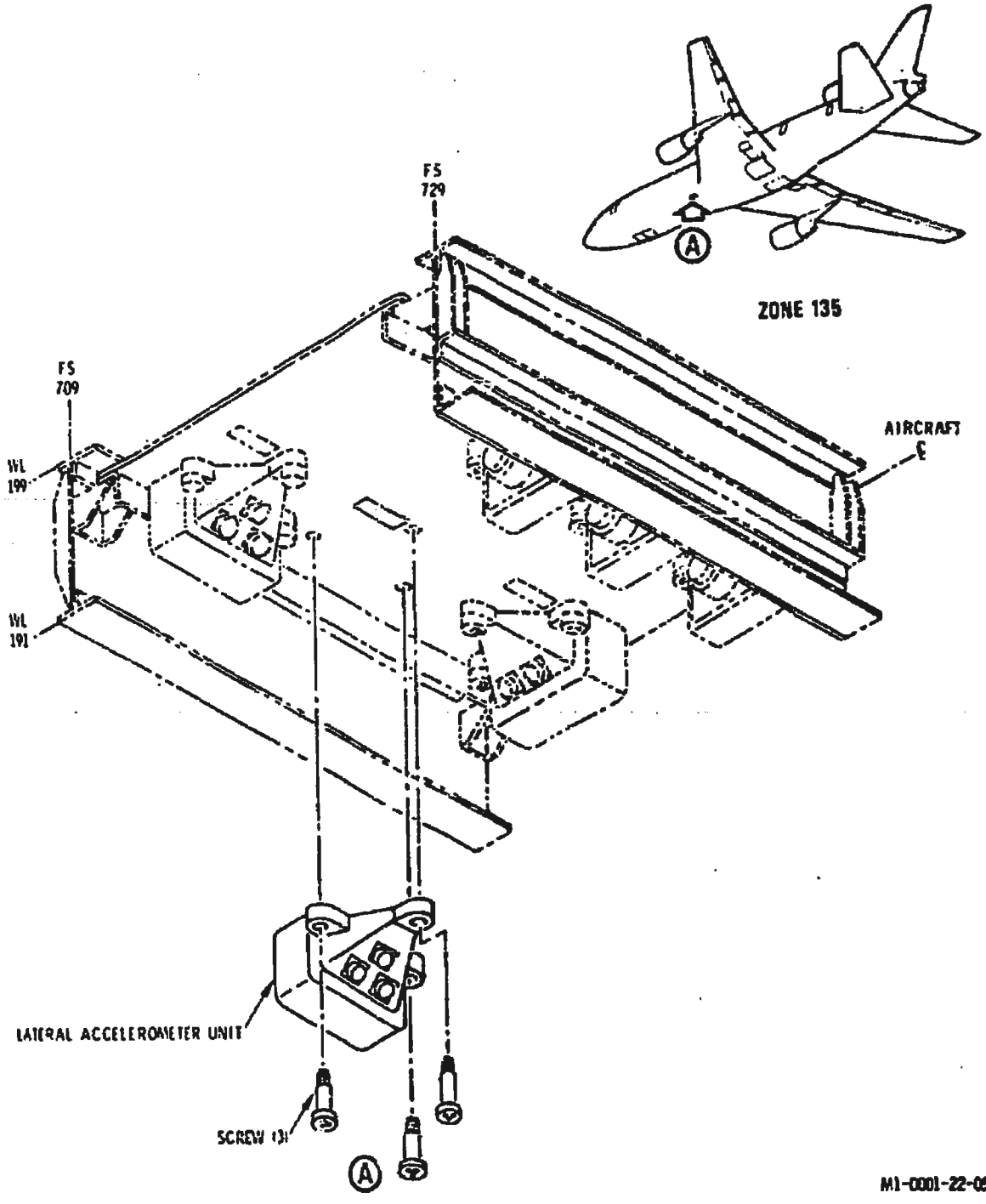
(10) Orient accelerometer in direction of mounting.

C (11) Tilt accelerometer approximately 30 degrees right side
C down for an aircraft slip to the left simulation.
C While accelerometer is being tilted, verify that ADI
C command bars are indicating fly right (or bring right
C wing down) command. (12) On APFDS ENGAGE panel, set both FD switches to OFF.

(13) Turn off electrical power (Ref. 24-25-00).

(14) Position accelerometer on mount and secure with mounting screws (Ref. Fig. 401).

R (15) Close GYROSCOPE ACCESS PANEL.



R Lateral Accelerometer Unit - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

ROLL AFCS TRANSDUCERS (LEFT INBOARD AILERON) MAINTENANCE PRACTICES

1. General

When the Roll AFCS Transducer No. 1 or No. 2 is inoperative, Dual AUTOLAND will not be available. The following procedure specifies the method used to deactivate a Roll AFCS transducer if the aircraft is to be dispatched with one unit inoperative.

2. Maintenance Practices

A. Deactivation

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

(1) On FCES control panel, depress YAW SAS-1 (or YAW SAS-2) switchlight to indicate OFF as appropriate.

(2) Placard flight station AP-A (or AP-B) and YAW SAS-1 or (YAW SAS-2) INOPERABLE DUAL AUTOLAND NOT AVAILABLE

(3) Make appropriate entry in aircraft log book.

AILERON DUAL POSITION TRANSDUCER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Aileron holding devices (aileron faired)

C Gen 3109 Test Harness Dual Position Transducer, IT&E Manuel,
C 22-12-01

Triplet Model 601 - ac voltmeter capable of reading 100 MV full scale

2. Referenced Procedures

R 22-13-03 Aileron Dual Position Transducer - Adjustment and
R Test

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

NOTE: The following removal/installation procedure is
R applicable for the No. 1 and No. 2 transducers.

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210,
R open and tag following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - YAW SAS (A5)NO. 2 SYSTEMS - YAW SAS (A23)

(2) Open access door 551AB.

(3) Disconnect electrical connector from transducer.

(4) Remove bolt, washers, and nut from transducer-holding clamp on transducer mount.

(5) Cut safety wire and loosen three screws on bellcrank
R which is secured to spline.

(6) Spread clamp and remove transducer.

B. Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Verify circuit breakers opened in Step A(1) are open and tagged.

(2) Secure left inboard aileron in faired (neutral)position with a holding device.

CAUTION: DO NOT FORCE ROTATION OF TRANSDUCER BEYOND INTERNAL STOPS (±120 DEGREES FROM EZ INDEX MARKS)

(3) Rotate transducer rotor shaft to align shaft electrical zero (EZ) index mark with EZ index mark on transducer housing (Ref. Fig. 401).

(4) Insert shaft end of transducer through clamp on transducer mount and serrated hole in mating bellcrank.

(5) Install but do not tighten bolt, washers, and nut to transducer-holding clamp on transducer mount (Ref. Fig. 401).

(6) Tighten and safety wire three screws on bellcrank which is secured to spline.

CAUTION: THE EZ INDICES MUST BE ALIGNED.

(7) Connect position transducer breakout box to transducer receptacle, and to transducer electrical connector.

(8) Connect ac voltmeter to position transducer breakout box as follows:

AC Voltmeter		Breakout Box Receptacle (J1)
Input (High)	to	Pin 2
Input (Low)	to	Pin 8

NOTE: Second Transducer Null

R will be Checked in Step 12.

(9) Remove tags and close circuit breakers opened in Step A(1).

(10) Adjust transducer housing until the ac voltmeter indicates a null less than 60 MV.

(11) Torque bolt, washers, and nut on clamp to 30-35 lb-in.

(12) Ensure that ac voltmeter indicates a null less than 60 MV.

R (a) Connect ac voltmeter to position transducer breakout box as follows:

AC Voltmeter	Receptacle (J1)
Input (High)	Pin 11
Input (Low)	Pin 9

(b) Reading obtained on Pins 9 and 11 should be approximately the same as the reading obtained in Step (12) above.

R (c) If reading obtained is higher than that in Step (12) (higher than 60MV), leave ac voltmeter connected to these pins and repeat Steps (10) thru (12).

R (d) Recheck both nulls for less than 60MV.

(13) Remove support from aileron, and allow aileron to fully drop.

(14) The ac voltmeter should indicate approximately 4 vac.

(15) Open and tag circuit breakers listed in Step A(1).

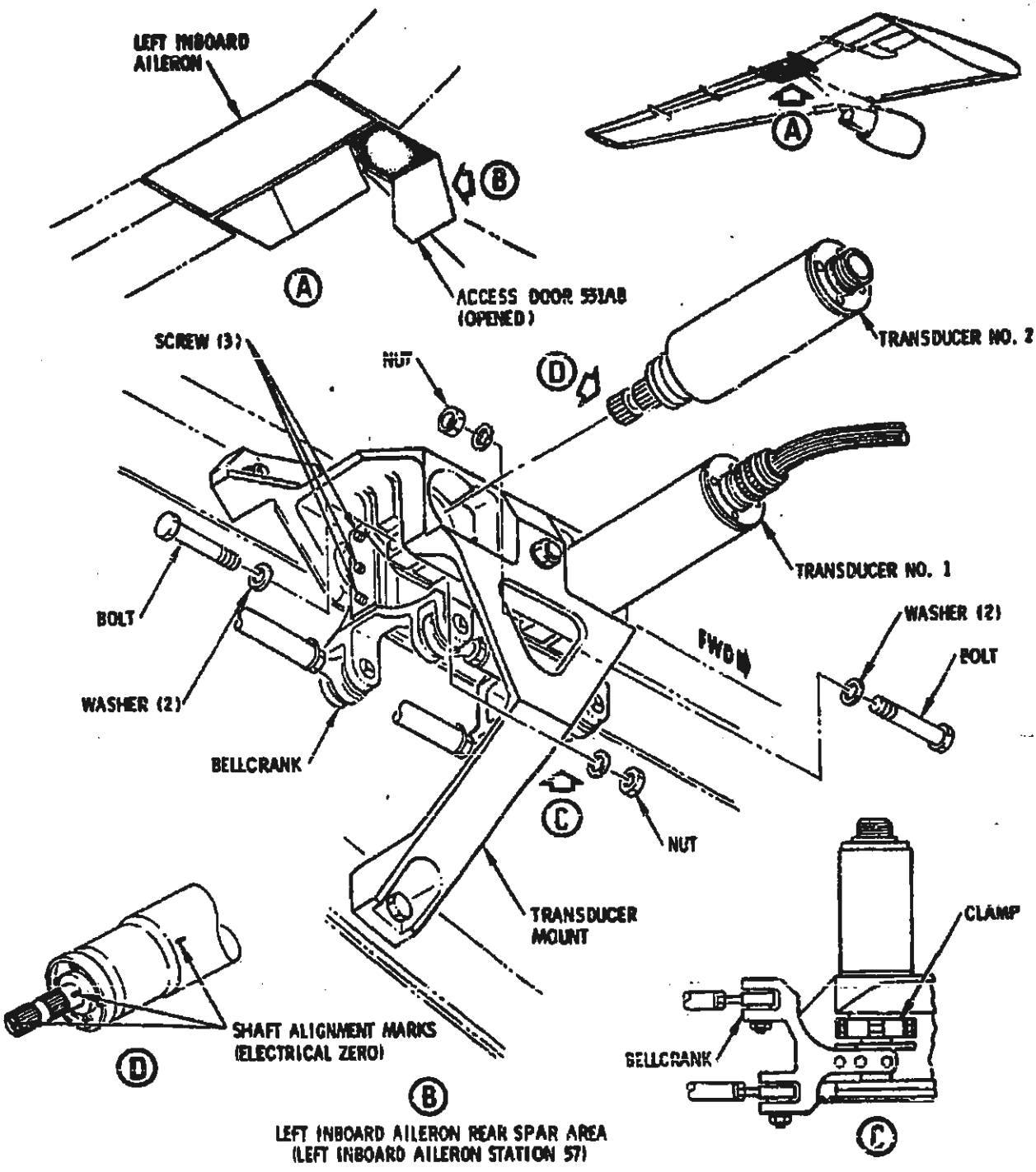
(16) Disconnect position transducer breakout box connectors.

(17) Connect electrical connector to transducer.

(18) Close access door 551AB.

(19) Close circuit breakers listed in Step A(1).

(20) Perform aileron dual position transducer adjustment and test procedure (Ref. 22-13-03).



R Aileron Dual Position Transducer - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

AILERON DUAL POSITION TRANSDUCER - ADJUSTMENT AND TEST

1. Referenced Procedure

R 21-00-00 Air Conditioning System - Maintenance Practices

24-00-00 Electrical Power - Maintenance Practices

29-11-00 Hydraulic Power System - Maintenance Practices

2. Adjustment/Test

The aileron dual position transducer operational test provided below requires that other auto flight system components and associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that equipment cooling is on (Ref. 20-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

(4) Verify that hydraulic system A, B and C indicate 3000 psi.

(5) On PFCS panel, set switchlights as follows:

Switchlight	Position
RUDDER	On (dark)
AILERON L OUTBD	On
AILERON L INBD	On
AILERON R INBD	On
AILERON R OUTBD	On

(6) On flight control panel, set switchlights as follows:

Switchlight	Position
RUDDER LIMITER	
MECHANICAL MNL-PUSH	On (dark)
MECHANICAL ±8° - ±30°	±30°
R HYDRAULIC OVRD-PUSH	On (dark)

NOTE: The MECHANICAL MNL-PUSH and ±8° - ±30° switchlights are only on flight control
R panels installed on aircraft 001-017.

(7) Verify that the following circuit breakers are closed:

PILOTS OVHD CB PNL CB 1

YAW SAS (A5)

FCES COMPUTERS AC & L AOA (B5)

INSTR XFMR NO. 3 (D27)

SURF POSN IND (J23)

FE/SO OVHD CB PNL CB 2

R AOA (F1)

AFCS WARNING - CAPT (K18)

AFCS WARNING - F/O (K19)

RUDDER SERVO A (K12)

RUDDER SERVO B (K13)

RUDDER SERVO C (K14)

RUDDER FUSING SYS (L16)

FE/SO AFT CB PNL CB3

PFCS ADS/DH (G8)

FLT CONT ALT ALERT (G9)

(8) On pilots eyebrow panel, depress WARNING CAUTION ADVISORY TEST switch to TEST.

On FCES panel, verify that YAW SAS 1 and 2 switchlights indicate OFF and FAIL.

On PFCS panel, verify that following legends are on.

Switchlight	Legend On
RUDDER	Red
AILERON L OUTBD	OFF and crosshatched section
AILERON L INBD	OFF and crosshatched section
AILERON R INBD	OFF and crosshatched section
AILERON R OUTBD	OFF and crosshatched section

On flight control panel, verify that the following legends are on:

Switchlight	Legend On
RUDDER LIMITER	
MECHANICAL	MNL-PUSH
MECHANICAL	±8° - ±30°
R HYDRAULIC	OVRD-PUSH

R NOTE: The MECHANICAL MNL/PUSH and ±8°/±30° switchlights are only on flight control panels installed on aircraft 001-017.

(9) On pilots eyebrow panel, depress WARNING CAUTION ADVISORY TEST switch to OFF.

All legends turned on in Step (8) will go off, except RUDDER LIMITER MECHANICAL ±30° legend.

(10) On FCES control panel, press both YAW SAS switchlights to OFF, and wait 1 minute before performing next step.

(11) Turn manual ROLL trim wheel until AIL trim indicator on SPI reads zero.

(12) Turn manual YAW trim wheel until RUD trim indicator on SPI reads zero.

(13) Set flaps to zero.

(14) Center control wheel (approximately).

(15) Verify that L and R inboard, and L and R outboard ailerons are in neutral position.

B. Dual Transducer Operational Test

(1) On FCES control panel, press both YAW SAS switchlights to on.

(2) Verify that YAW SAS 1 and 2 switchlight FAIL legends are off.

(3) On pilots center instrument panel, depress C/W ANN RESET switch to turn off the FLT CONT PNL legend if on.

(4) On FCES control panel, press YAW SAS 2 switchlight to OFF.

(5) On pilots overhead circuit breaker panel CB1, open YAW SAS (A23) circuit breaker No. 2.

(6) Rotate either control wheel full clockwise, counterclockwise then center.

On SPI, RUD indicator shall indicate rudder movement to right, left then center.

Observe left inboard aileron deflection down, up, then center.

On FCES panel, YAW SAS 1 switchlight shall not indicate FAIL.

(7) Turn on AP A.

(8) Set HEADING knob to aircraft heading.

(9) Press HDG switchlight to on.

HDG SEL message on AFCS MODES annunciators is in view.

(10) Slowly turn HEADING knob for 15 degree right turn, 15 degree left turn, then back to aircraft heading.

On SPI, RUD indicator shall indicate rudder movement to right, left, then center.

Observe left inboard aileron deflection down, up, then center.

Control wheel shall turn right, left, then center.

On FCES panel, YAW SAS 1 switchlight shall not indicate FAIL.

Autopilot shall remain engaged.

(11) Turn off AP A.

HDG switchlight goes off.

HDG SEL message goes out of view.

(12) Close circuit breaker opened in Step B(5), and wait one minute before performing next step.

(13) On FCES panel, press YAW SAS 2 switchlight to on, and YAW SAS 1 switchlight to OFF.

(14) On pilots overhead circuit breaker panel CB1, open YAW SAS (A5) circuit breaker No. 1.

(15) Rotate either control wheel full clockwise, counterclockwise then center.

On SPI, RUD indicator shall indicate rudder movement to right, left then center.

Observe left inboard aileron deflection down, up, then center.

On FCES panel, YAW SAS 2 switchlight shall not indicate FAIL.

(16) Turn on AP B.

(17) Set HEADING knob to aircraft heading.

(18) Press HDG switchlight to on.

R HDG SEL message on AFCS MODES annunciators is in-view.

(19) Slowly turn HEADING knob for 15 degree right turn, 15 degree left turn, then back to aircraft heading.

On SPI, RUD indicator shall indicate rudder movement to right, left, then center.

Observe left inboard aileron deflection down, up, then center.

Control wheel shall turn right, left, then center.

On FCES panel, YAW SAS 2 switchlight shall not indicate FAIL.

Auto pilot shall remain engaged.

(20) Turn off AP B.

HDG switchlight goes off.

HDG SEL message goes out of view.

(21) Close circuit breaker opened in Step B(14).

C. Test Completion

(1) On FCES panel, press YAW SAS 2 switchlight to OFF.

(2) Turn off hydraulic power (Ref. 29-11-00).

(3) Turn off electrical power (Ref. 24-00-00).

R # FD HEADING SELECT MODE - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting FD Heading Select Mode faults are included in this section of the manual. FD Heading Select Mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use schematic diagrams, identified by a SCHEM number, which supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Identification

R Table 101 is a list of the FD Heading Select Mode fault isolation diagrams and schematics. Figure 101 and 102 provide component location for FD Heading Select Mode troubleshooting.

R A. General

R FD heading select mode fault isolation contains two levels of troubleshooting: (1) fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2B) trouble shoots a specific FD heading select mode problem. System oriented fault isolation (Ref. 22-13-31, Page 501) tests and trouble shoots FD heading select mode problems.

R B. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the FD heading select mode by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-13-31, Page 501) to isolate problem.

R Figure 104 provides diagnostic steps to further isolate the fault. The diagnostic steps are in a flow chart form which contains complete fault isolation procedures for each fault.

R Action instructions are contained within the blocks of the flow
R chart while the monitored results of the actions are outside the
R blocks. When using the flow charts, it is assumed that systems
R are in the normal operational mode, all relevant circuit
R breakers have been checked, and all applicable aircraft
R operational procedures have been accomplished.

R Figure 105 is a simplified schematic of the FD heading select
R function.

R TABLE 101

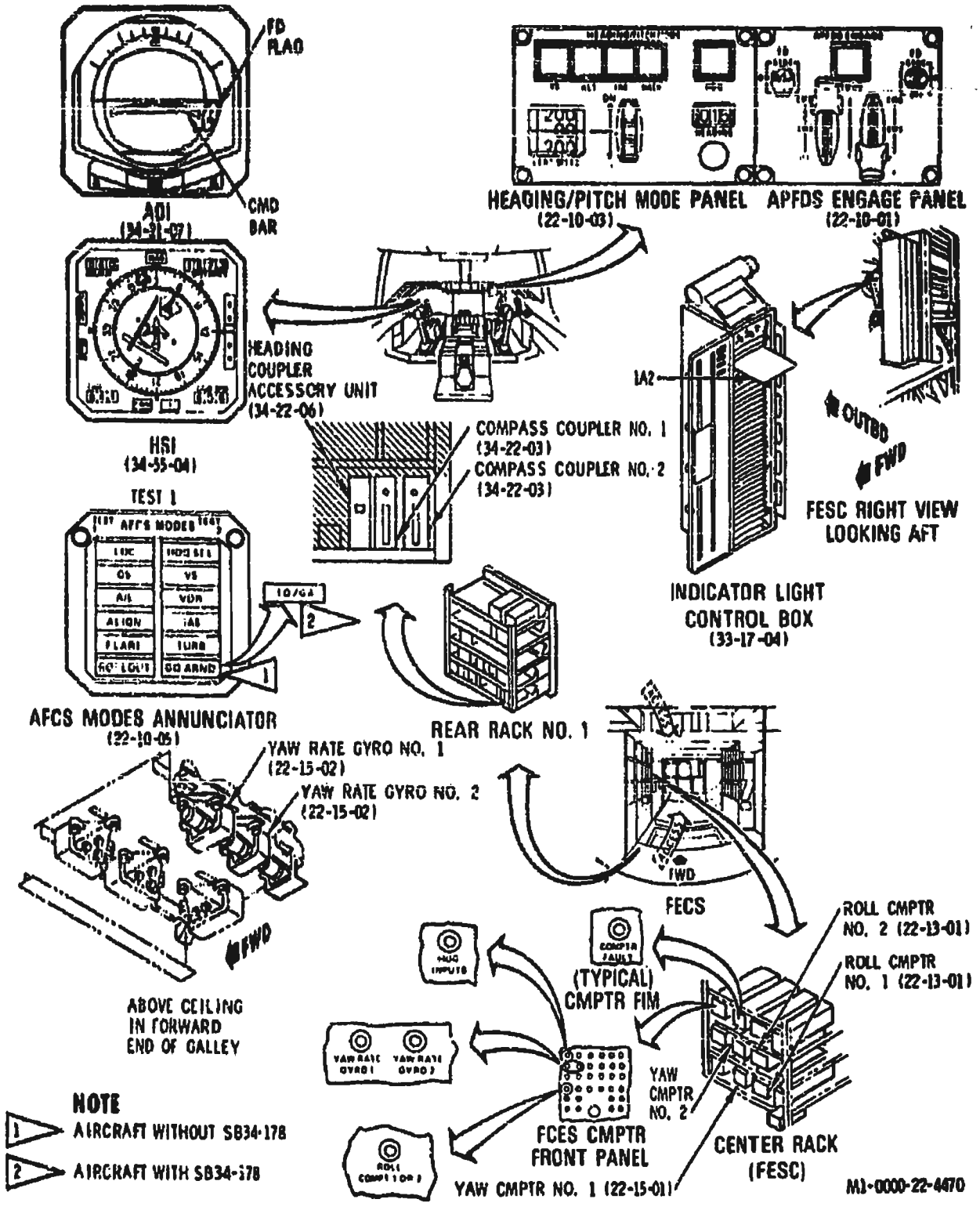
FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	FD Heading Select Mode Fault Identification
104	FD Heading Select Mode Faults
105	FD Heading Select Mode Simplified Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCESSORY UNIT – HEADING COUPLER	1	FESC, REAR RACK/112AB	34-22-06
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
CONTROL BOX – INDICATOR LIGHTS	1	FESC, AFT OF ELEC RACK/112AB	33-17-04
COUPLER – COMPASS	2	FESC, REAR RACK/112AB	34-22-03
GYRO – YAW RATE	3	GALY CLG/135DB	22-15-02
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05
INDICATOR – HORIZONTAL SITUATION	2	FLT STA, CAPT AND F/O INSTR PNL	34-55-04
PANEL – HEADING/PITCH MODE COMMAND	1	FLT STA, GLRSHLD PNL	22-10-03

M1-0000-22-2213

R Component Location Index
R Figure 101

R EFFECTIVITY: ALL
R
001B



R Component Locator Diagram
R Figure 102

EFFECTIVITY: ALL

FAULTS		FIM				NO FIM				
	Problem (Capt or F/O) Capt FIRM Codes With ·1 F/O FIRM Codes With ·2 X — Use With Both FIRM Codes	Troubleshooting Faulty LRU								
		Check FIM on LRU or on Front Panel of FCES Cmptr				Continuity Check or Replace				
No.		RC	YC	YRG	CC	HSI	HCAU	HDG/PITCH PNL	MODES ANN	ILCB
	"BOTH FD ON AND BOTH AP OFF" (Ref. Fig. 104)									
1	HEADING set knob loose, stuck (frozen)							X		
2	Capt (F/O) heading bug does not agree with HEADING set in				1/2	C/F	X	X		
3	Capt (F/O) ADI CMD bar does not follow other ADI bar in roll. Both FD are engaged in HDG SEL mode	1/2	1/2	1/2	1/2			X		
4	FD flag in-view, CMD bar out-of-view on Capt (F/O) ADI when both FD are engaged in HDG SEL mode. A/P (same side) drops from CMD to CWS if turned on	1/2			1/2				C/F	
5	HDG SEL mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in HDG SEL mode. CMD bar (same side) follows other CMD bar in roll	1/2								
6	HDG SEL mode not displayed on Capt (F/O) AFCS modes ann when both FD are engaged in HDG SEL mode. CMD bar (same side) does not follow other CMD bar in roll	1/2						X		
7	HDG mode light does not come on when depressed. Both HDG SEL messages are in-view							X		1A2

Abbreviations		Removal and Install Ref.	
		Chapt	Page
CC	Compass Coupler	34-22-03	401
ILCB	Indicator Lights Control Box Card	33-17-04	401
HCAU	Heading Coupler Accessory Unit	34-22-06	401
HDG PITCH PNL	Heading/Pitch Modes Panel	22-10-03	401
HSI	Horizontal Situation Indicator	34-55-04	401
Modes Ann	AFCS MODES Annunciator	22-10-05	401
RC	Roll Computer	22-13-01	401
YC	Yaw Computer	22-15-01	401
YRG	Yaw Rate Gyro	22-15-02	401

HOW TO USE

1. Find flight squawk in FAULTS column
2. Check FIM or LRU listed in FIM column related to FAULTS. Slash FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 and 105

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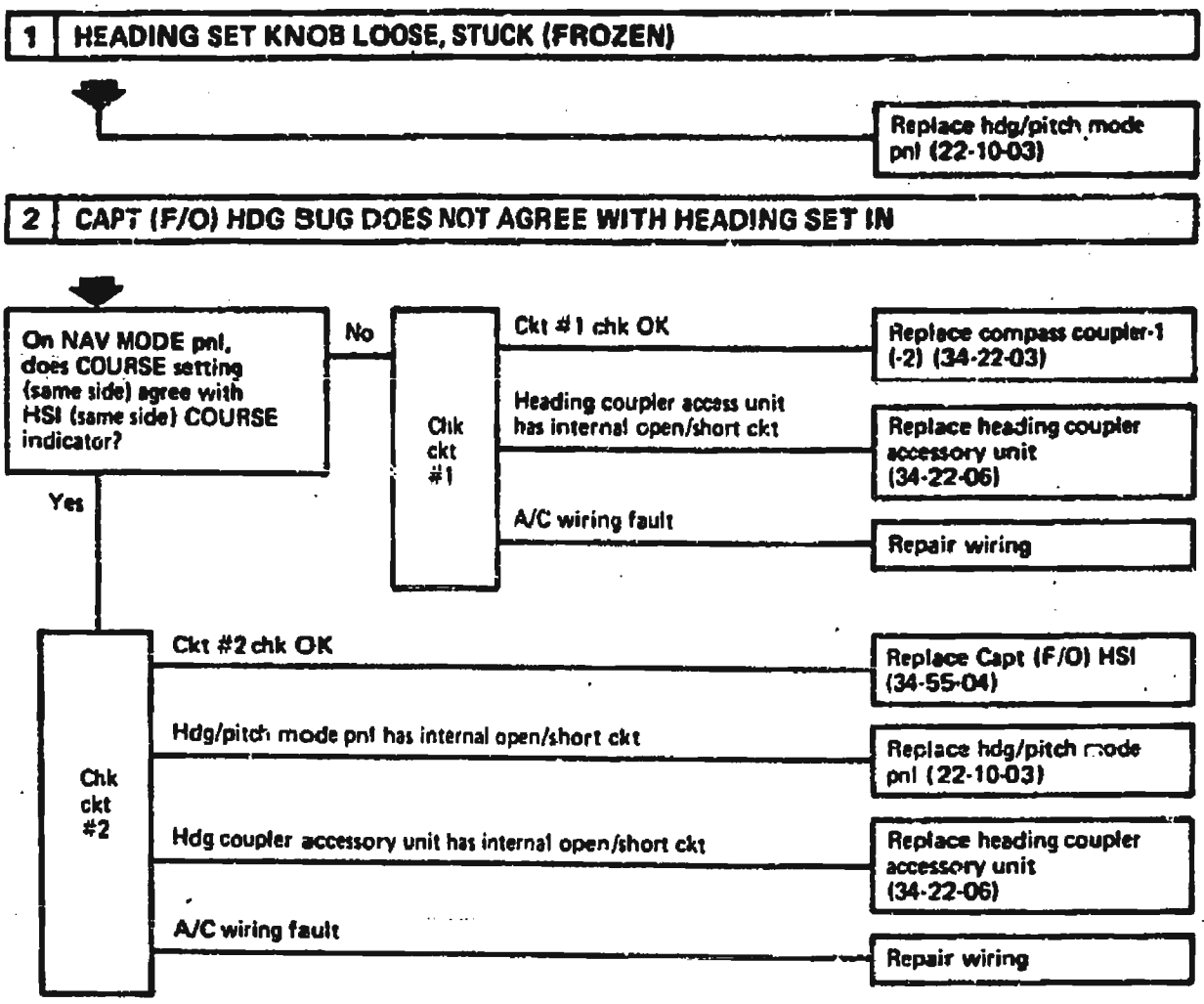
R R FD Heading Select Mode Fault Identification
Figure 103

R R 001B EFFECTIVITY: ALL


1 HEADING SET KNOB LOOSE, STUCK (FROZEN)
Replace hdg/pitch mode pnl (22-10-03)
2 CAPT (F/O) HDG BUG DOES NOT AGREE WITH HEADING SET IN
On NAV MODE pnl, does COURSE setting (same side) agree with HSI (same side) COURSE indicator?
No
Yes
Chk ckt #1
Ckt #1 chk OK
Replace compass coupler-1 (-2) (34-22-03)
Heading coupler access unit has internal open/short ckt
Replace heading coupler accessory unit (34-22-06)
A/C wiring fault
Repair wiring
Chk ckt #2
Ckt #2 chk OK
Replace Capt (F/O) HSI (34-55-04)
Hdg/pitch mode pnl has internal open/short ckt
Replace hdg/pitch mode pnl (22-10-03)
Hdg coupler accessory unit has internal open/short ckt
Replace heading coupler accessory unit (34-22-06)
A/C wiring fault
Repair wiring

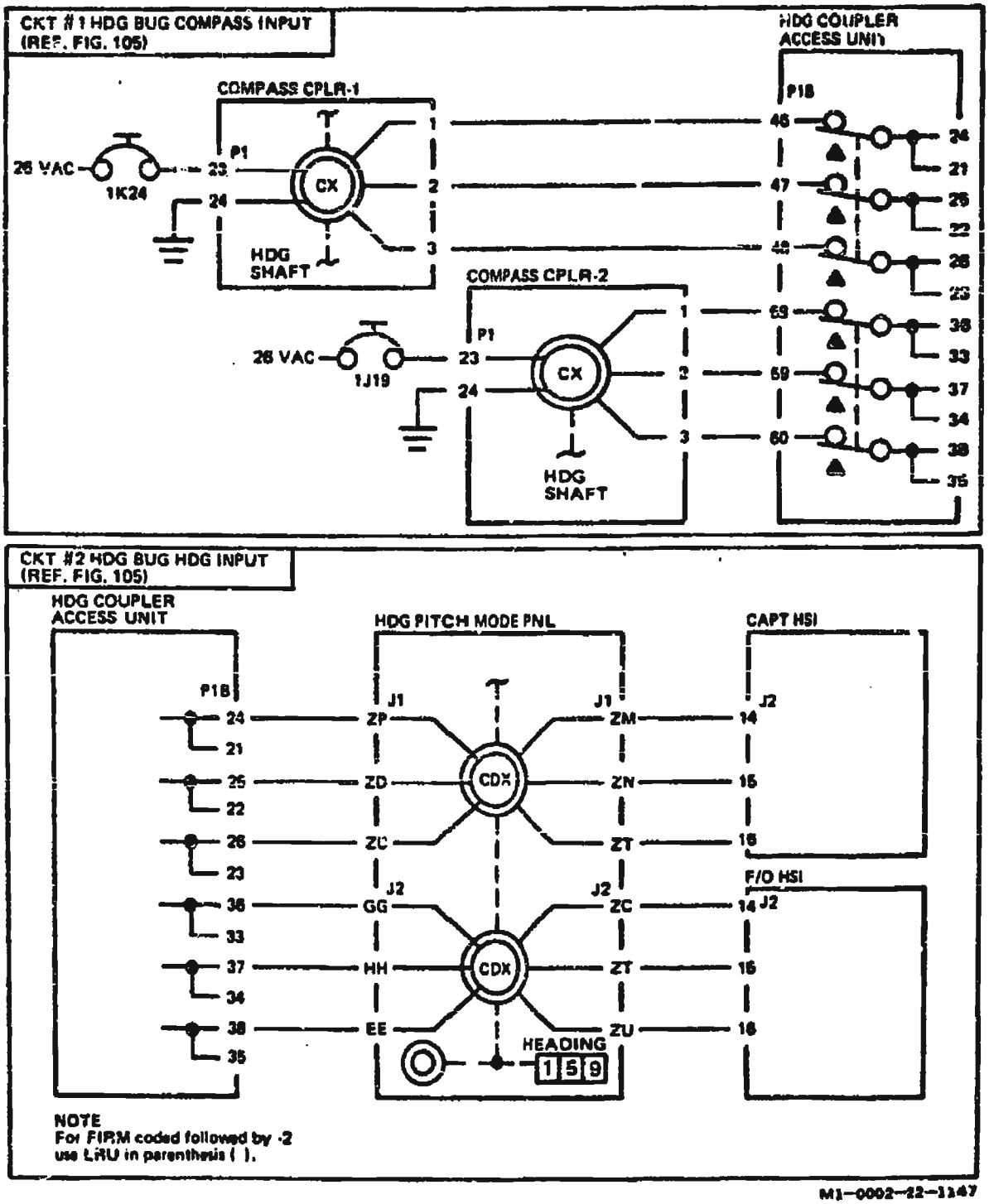
NOTE
For FIRM codes followed by -2 use LRU in parenthesis ( )

M1-65500-22-1145

R R FD Heading Select Mode Faults
Figure 104 (Sheet 1)

R EFFECTIVITY: ALL
R R
0018

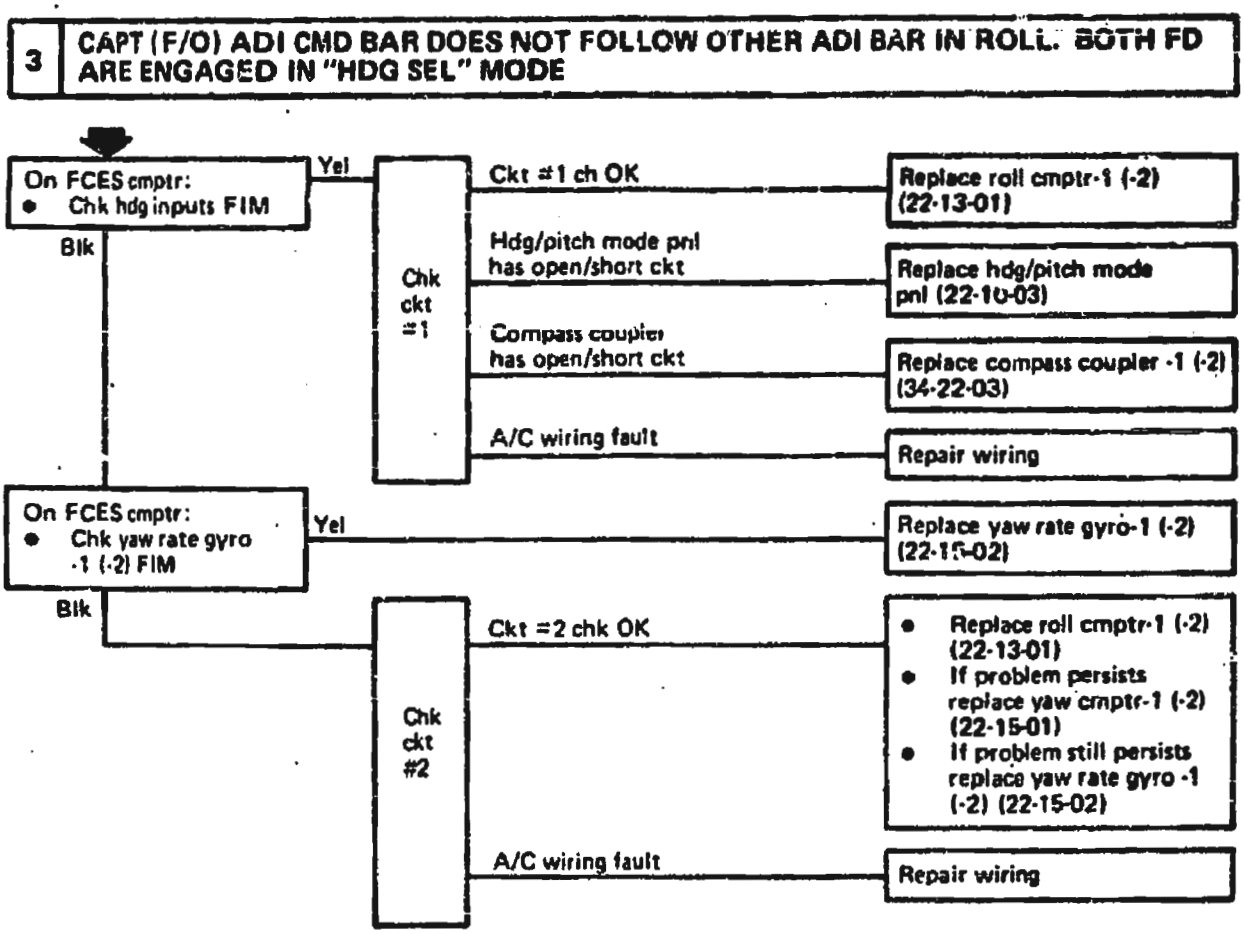
2 CONTINUED



M1-0002-22-1147

R FD Heading Select Mode Faults
R Figure 104 (Sheet 2)

R EFFECTIVITY: ALL
R
001B


3
CAPT (F/O) ADI CMD BAR DOES NOT FOLLOW OTHER ADI BAR IN ROLL. BOTH FD ARE ENGAGED IN "HDG SEL" MODE
On FCES cmptr:
• Chk hdg inputs FIM
Yel
Blk
Chk ckt #1
Ckt #1 ch OK
Replace roll cmptr-1 (-2) (22-13-01)
Hdg/pitch mode pnl has open/short ckt
Replace hdg/pitch mode pnl (22-10-03)
Compass coupler has open/short ckt
Replace compass coupler -1 (-2) (34-22-03)
A/C wiring fault
Repair wiring
On FCES cmptr:
• Chk yaw rate gyro -1 (-2) FIM
Yel
Replace yaw rate gyro-1 (-2) (22-15-02)
Blk
Chk ckt #2
Ckt #2 chk OK
• Replace roll cmptr-1 (-2) (22-13-01)
• If problem persists replace yaw cmptr-1 (-2) (22-15-01)
• If problem still persists replace yaw rate gyro -1 (-2) (22-15-02)
A/C wiring fault
Repair wiring

NOTE
For FIRM codes followed by -2 use LRU in parenthesis ( )

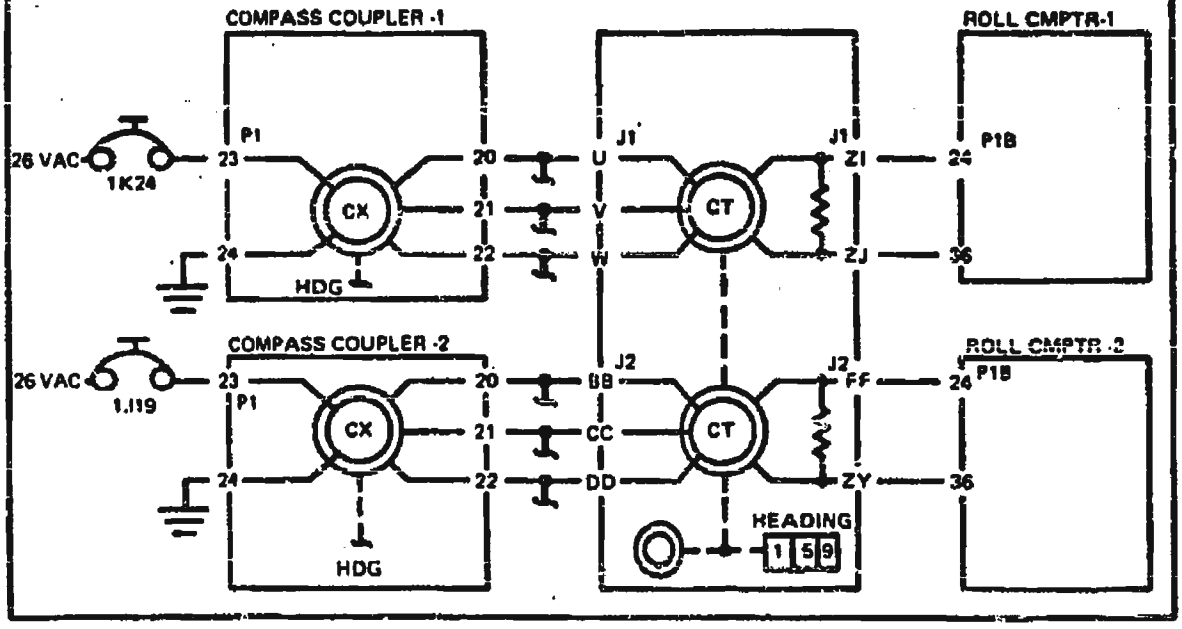
M1-0100-22-1149

R FD Heading Select Mode Faults
R Figure 104 (Sheet 3)

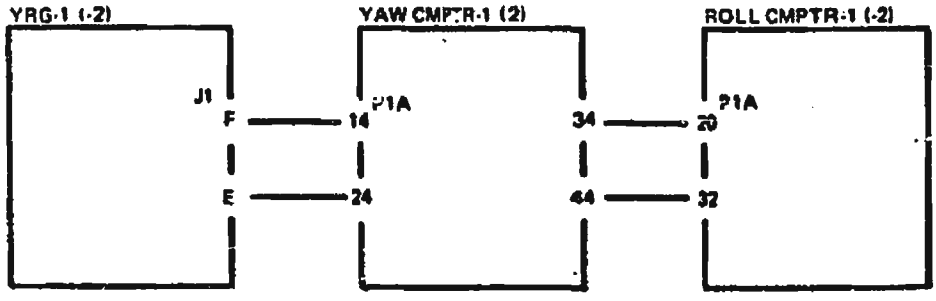
R EFFECTIVITY: ALL
R
0018

3 CONTINUED

CKT #1 HDG INPUT
(REF. FIG. 105)



CKT #2 PROCESSED YAW RATE INPUT
(REF. FIG. 105)



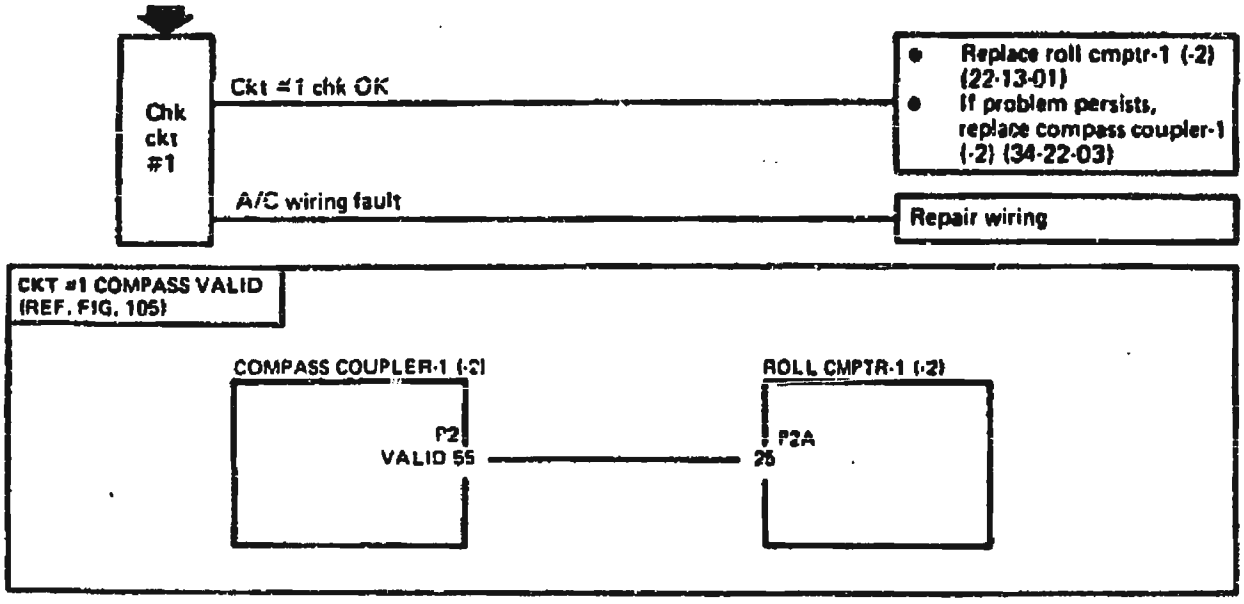
NOTE
For FIRM codes followed by -2
use LRU in parenthes's ( )

M1-0001-22-1150

R FD Heading Select Mode Faults
R Figure 104 (Sheet 4)

R EFFECTIVITY: ALL
R
001B

4	FD FLAG IN-VIEW, CMD BAR OUT-OF-VIEW ON CAPT (F/O) ADI WHEN BOTH FD ARE ENGAGED IN HDG SEL MODE. A/P (SAME SIDE) DROPS FROM CMD TO CWS IF TURNED ON



NOTE
For FIRM codes followed by -2 use LRU in parenthesis ( )

M1-0001-22-1151

R FD Heading Select Mode Faults
R Figure 104 (Sheet 5)

R EFFECTIVITY: ALL
R
001B

5	"HDG SEL" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "HDG SEL" MODE. CMD BAR (SAME SIDE) FOLLOWS OTHER CMD BAR IN ROLL

On Capt (F/O) AFCS modes ann.
- Depress TEST 1 sw.
- HDG SEL message is displayed on AFCS modes ann.
- HDG light (on – hdg/pitch mode pnl) comes on

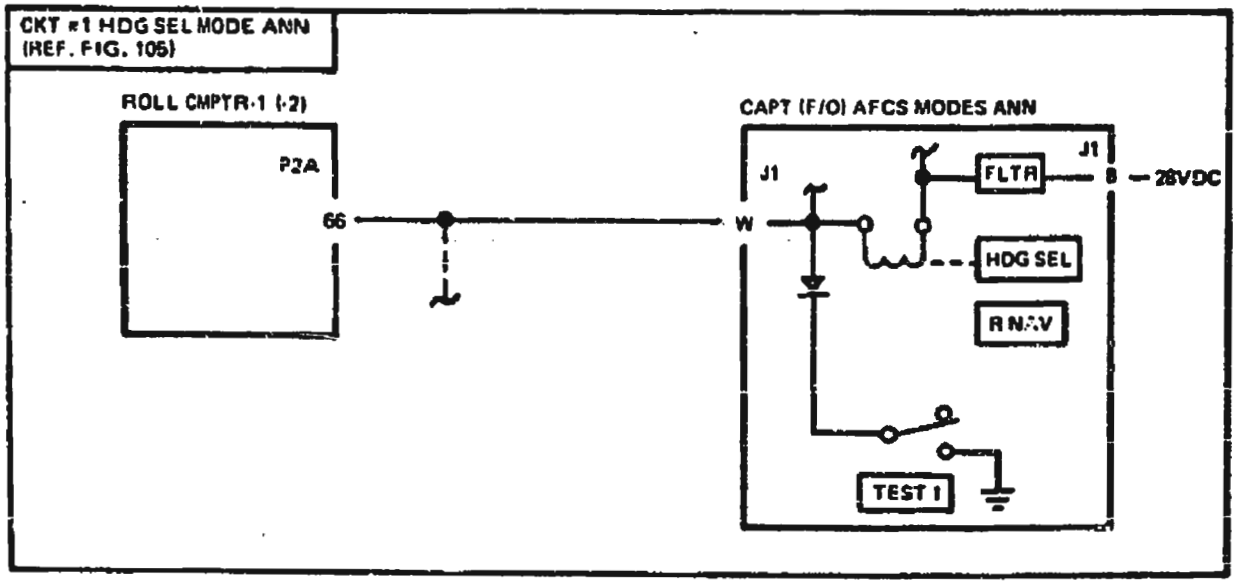
No HDG SEL message → Replace Capt (F/O) AFCS modes ann (22-10-05)

No HDG light → Chk Ckt #1
- A/C wiring fault → Replace wiring
- AFCS modes ann has internal open ckt → Replace Capt (F/O) AFCS modes ann (22-10-05)

TEST 1 OK

Swap roll cmptr 1 and 2 → Trouble follows roll cmptr → Replace roll cmptr -1 (-2) (22-13-01)

A/C wiring fault → Repair wiring P2A-66 to J1-W (Ref. Ckt #1)



NOTE
For FIRM codes followed by -2, use LRU in parenthesis

M1-0001-22-1152

R R FD Heading Select Mode Faults
Figure 104 (Sheet 6)

R R 001B EFFECTIVITY: ALL

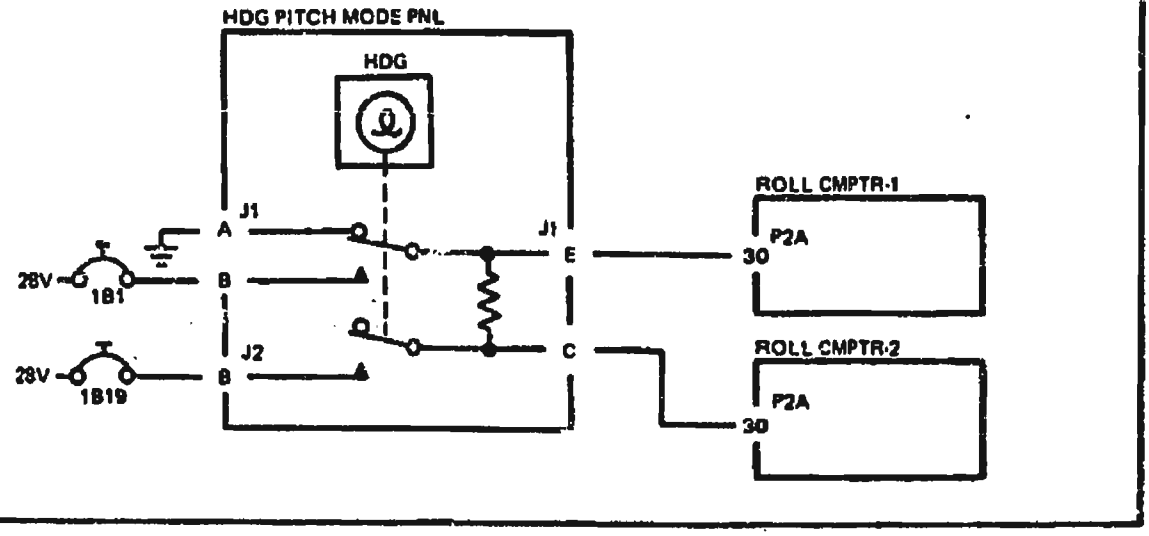
6	"HDG SEL" MODE NOT DISPLAYED ON CAPT (F/O) AFCS MODES ANN WHEN BOTH FD ARE ENGAGED IN "HDG SEL" MODE. CMD BAR (SAME SIDE) DOES NOT FOLLOW OTHER CMD BAR IN ROLL

Chk ckt #1

- Ckt #1 ckt OK → Replace roll cmptr-1 (-2) (22-13-01)
- Hdg/pitch mode pnl has open/short ckt → Replace hdg pitch mode pnl (22-10-03)
- A/C wiring fault → Repair wiring

NOTE
For FIRM codes followed by -2, use LRU in parenthesis ( )

CKT #1HDG SEL ENGAGE SIGNAL (REF. FIG. 105)

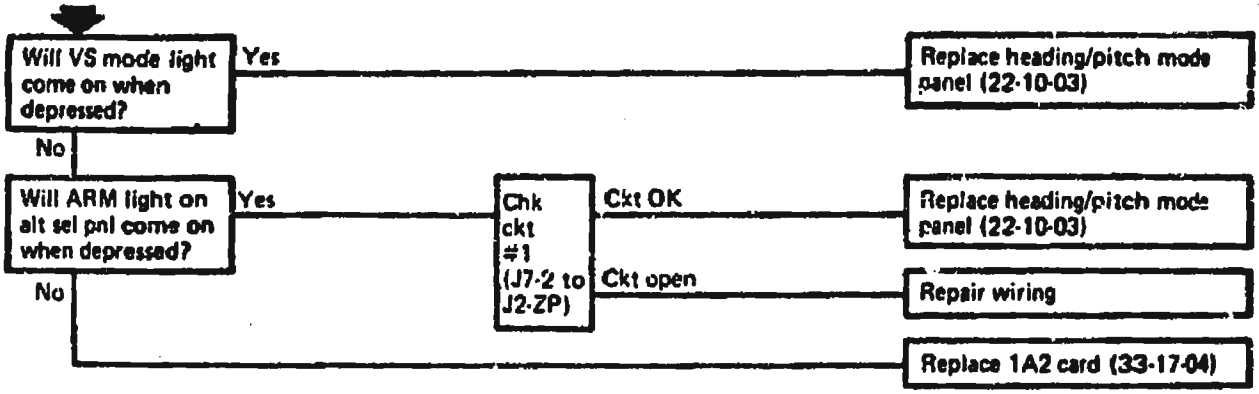


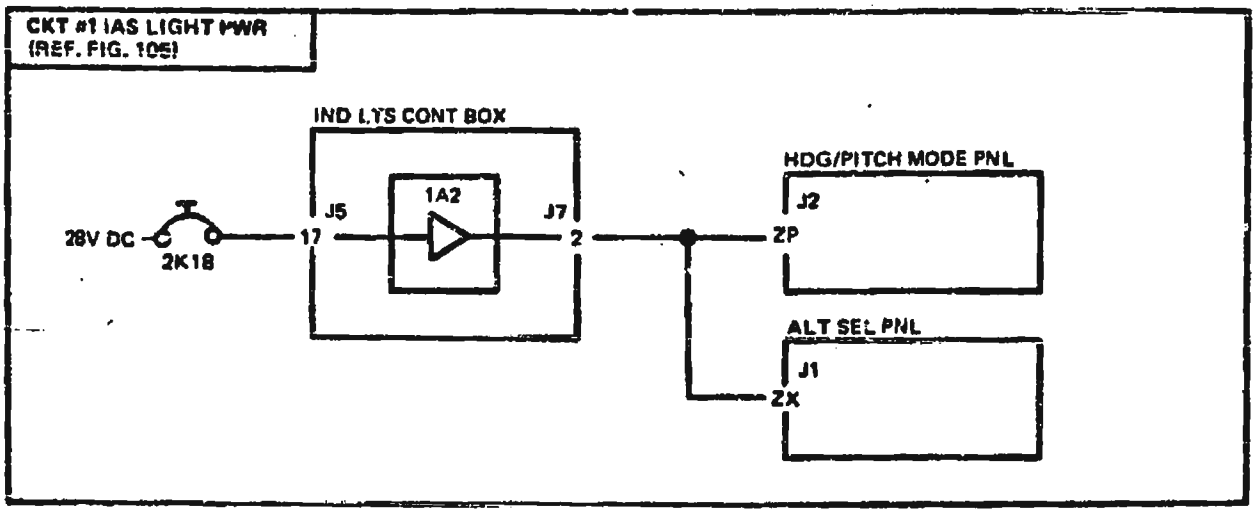
M1-0001-22-1153

R FD Heading Select Mode Faults
R Figure 104 (Sheet 7)

R EFFECTIVITY: ALL
R
001B

7 HDG MODE LIGHT DOES NOT COME ON WHEN DEPRESSED. HDG SEL MESSAGES IN VIEW





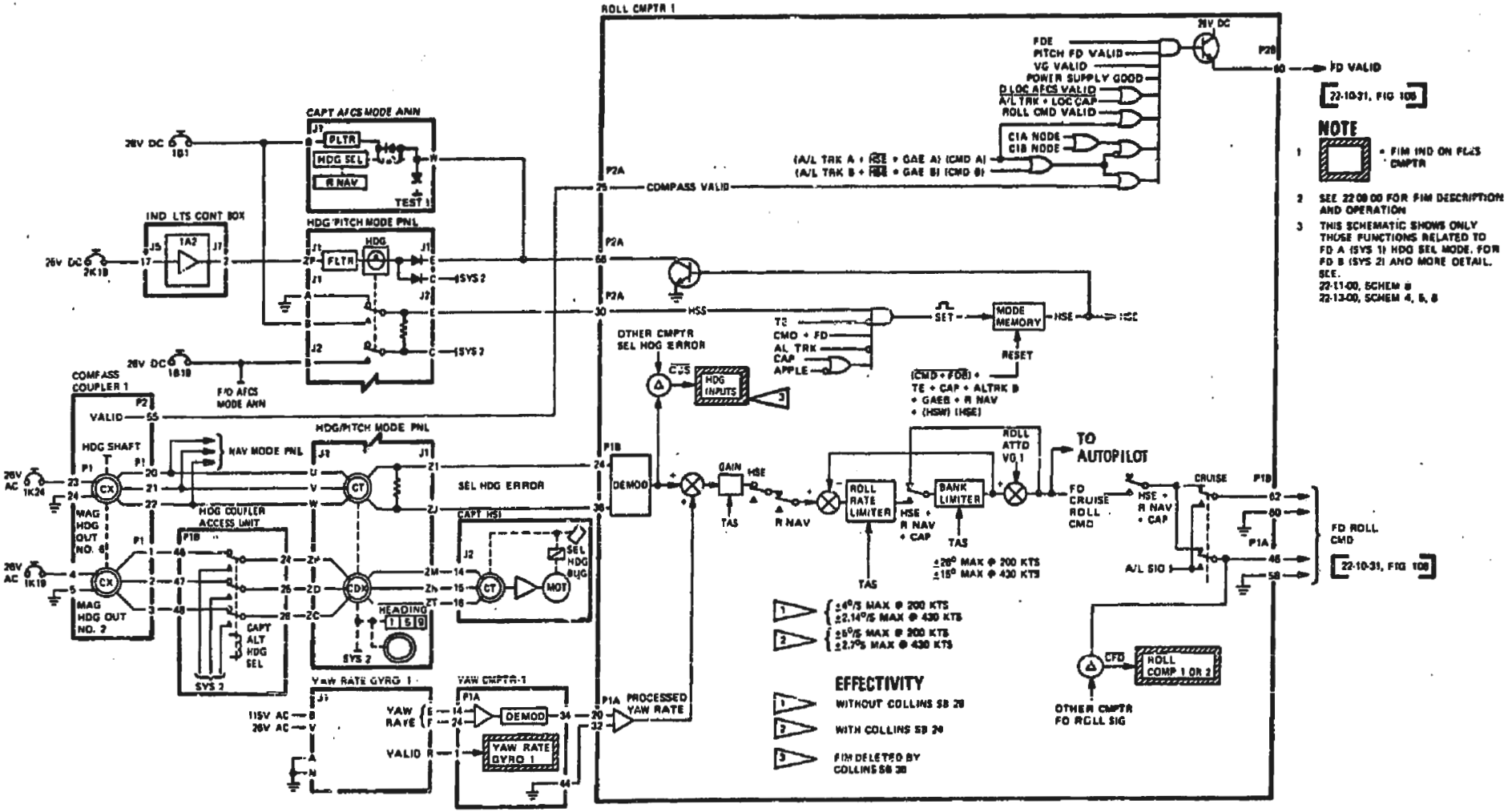
NOTE

For FIRM codes followed by -2, use LRU in parenthesis ( ).

M1-0001-22-1154

FD Heading Select Mode Faults
Figure 104 (Sheet 8)

EFFECTIVITY: ALL



M1-0007-22-1156

R FD Heading Select Mode Simplified Schematic
R Figure 105

R EFFECTIVITY: ALL
R
0018

R # FD HEADING SELECT MODE - ADJUSTMENT AND TEST

R 1. General

R The fault detection test procedure in Paragraph 4 is used in
R conjunction with the fault isolation procedure in Paragraph 5.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 5 for appropriate fault isolation.

R 2. Equipment and Materials

R Type MB-1 Pitot/Static Field Tester, Burton 2024B Pitot/Static
R Tester, or equivalent

R 3. Referenced Procedures

R 22-12-00 APFDS Modes of Operation - Maintenance Practices

R 22-02-01 AFCS Lamps and Annunciators - Fault Isolation

R 22-10-31 Flight Director Basic Mode - Fault Isolation

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00, maintenance
R practices.

R B. FD Heading Select Mode Test

R (1) On APFDS ENGAGE panel, set both FD switches to ON.

R RESULT:

R Both ADI command bars come into view and are
R level.

R Both ADI FD flags are out of view.

R (2) On HEADING/PITCH MODE panel,, depress HDG switchlight
R to on.

R RESULT:

R On both AFCS MODES annunciators, HDG SEL messages
R are displayed.

On both ADIs, FD flags are out of view, and command bars are centered and level.

(3) On CB1, open CMPS COUPLER (G7) and (G26) circuit breakers.

RESULT:

On both ADIs, FD flags are displayed, and command bars are biased out of view.

(4) Close G7 and G26 circuit breakers.

(5) On HEADING/PITCH MODE panel, set HEADING knob to 10 degrees more than aircraft heading.

RESULT:

R On both ADI, command bars indicate right roll.

(6) On CB1, open AIR DATA CMPTR (G8) and (G27) circuit breakers.

RESULT:

R On both ADI, FD flags are displayed, and command bars are biased out of view.

(7) Close G8 and G27 circuit breakers.

(8) If not connected, connect air data testers to CADC systems No. 1 and 2. On each tester, establish an airspeed of 450 knots.

RESULT:

R On both ADI, command bars indicate an increase in right roll.

(9) On galley ceiling,, zone 135, carefully remove yaw rate gyro No. 1 from ceiling with cables connected.

(10) Rotate yaw rate gyro No. 1 approximately 180 degrees clockwise (nose-right) in approximately 2 seconds.

RESULT:

On Capt ADI, command bar indicates a temporary decrease in right roll.

(11) Reinstall yaw rate gyro No. 1 in mount.

R R (12) Carefully remove yaw rate gyro No. 2 from ceiling with cables connected.

R R (13) Rotate yaw rate gyro No. 2 approximately 180 degrees clockwise (nose-right) in approximately 2 seconds.

R RESULT:

R R On F/O ADI, command bar indicates a temporary decrease in right roll.

R (14) Reinstall yaw rate gyro No. 2 in mount.

R (15) On each tester, reduce airspeed to zero knots.

R (16) Set HEADING knob to aircraft heading.

R (17) Set both FD switches to OFF.

R 5. Fault Isolation

R A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 4B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R FD Heading Select Mode Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
4B(1)	ADI fault indication	(1)
4B(2)-1	HDG switchlight is not illuminated	(2)
4B(2)-2	No HDG SEL display on Capt AFCS MODES annunciator	(3)
4B(2)-3	No HDG SEL display on F/O AFCS MODES annunciator	(4)
4B(2)-4	FD flag displayed on Capt ADI	(5)
4B(2)-5	Command bar not level on Capt ADI	(6)
4B(2)-6	FD flag displayed on F/O ADI	(7)
4B(2)-7	Command bar not level on F/O ADI	(8)
4B(3)-1	No fault indication on Capt ADI	(9)
4B(3)-2	No fault indication on F/O ADI	(10)
4B(5)-1	Command bar motion incorrect on Capt ADI	(11)
4B(5)-2	Command bar motion incorrect on F/O ADI	(12)
4B(6)-1	No fault indication on Capt ADI	(13)
4B(6)-2	No fault indication on F/O ADI	(14)

FD Heading Select Mode Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(8)-1	Command bar motion incorrect on Capt ADI	(15)
4B(8)-2	Command bar motion incorrect on F/O ADI	(16)
4B(10)	Command bar motion incorrect on Capt ADI	(17)
4B(13)	Command bar motion incorrect on F/O ADI	(18)

Schematics for Fault Isolation of FD Heading Select Mode Problem
Table 502

TITLE	LOCATION
Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic	22-13-00, Schem 5
HDG SEL, HDG Hold, Capture, A/L TRK-B and R-NAV Mode Engage Logic Schematic	22-13-00, Schem 8

B. FD Heading Select Mode Faults

(1) Fault: ADI fault indication

(a) Perform Steps (1) and (2) of FD basic mode test
R procedure (Ref. 22-10-31).

---

(2) Fault: HDG switchlight not illuminated

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated HDG switchlight fault?

Yes: Replace HEADING/PITCH MODE panel (Ref. 22-10-03).

No: Perform mode annunciation press-to-test fault isolation procedures (Ref. 22-02-01).

---

(3) Fault: On Capt AFCS MODES annunciator, no HDG SEL display

(a) Can mode annunciation press-to-test fault isolation procedure (Ref. 22-02-01) be performed with no indicated HDG SEL messge fault?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists, replace Capt AFCS MODES ANNUNCIATOR (Ref. 22-10-05).

No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

---

(4) Fault: On F/O AFCS MODES annunciator, no HDG SEL display

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated HDG SEL message fault?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03). If problem persists,

R replace F/O AFCS MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation procedure (Ref. 22-02-01).

R ---

R (5) Fault: On Capt ADI, FD flag displayed

R (a) Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (6) Fault: On Capt ADI, command bar not level

R (a) Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03).

R ---

R (7) Fault: On F/O ADI FD flag displayed

R (a) Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (8) Fault: On F/O ADI, command bar not level

R (a) Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace HEADING/PITCH MODE panel (Ref. 22-10-03).

R ---

R (9) Fault: On Capt ADI, no fault indication

R (a) On CB1, open NO. 1 SYSTEMS/PITCH & ROLL (A6) circuit breaker. On Capt ADI, is FD flag in view?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).

R No: Replace Capt ADI (Ref. 34-21-07).

R ---

R (10) Fault: On F/O ADI, no fault indication

R (a) On CB1, open NO. 2 SYSTEMS/PITCH & ROLL (A24) circuit breaker. On F/O ADI, is FD flag in view?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).

R No: Replace F/O ADI (Ref. 34-21-07).

R ---

R (11) Fault: On Capt ADI, command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Go to Step (b).

R No: Go to Step (d).

R (b) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT
R DIR switchlight to illuminate ALTN legend. Does
R command bar on F/O ADI command right-roll?

R Yes: Replace heading coupler accessory unit (Ref.
R 34-22-06). If problem persists, replace Capt ADI
R (Ref. 34-21-07).

R No: Go to Step (c).

R (c) On Capt INSTRUMENT SOURCE SELECT panel, depress
R FLT DIR switchlight to illuminate ALTN legend. On
R Capt ADI, does command bar command right-roll?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).
R If problem persists, replace HEADING/PITCH MODE
R panel (Ref. 22-10-03).

R No: Replace heading coupler accessory unit (Ref.
R 34-22-06).

R (d) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT
R DIR switchlight to illuminate ALTN legend. On F/O
R ADI, does command bar command right-roll?

R Yes: Replace heading coupler accessory unit (Ref.
R 34-22-06). If problem persists, replace Capt ADI
R (Ref. 34-21-07).

R No: Replace roll computer No. 1 (Ref. 22-13-01).
R If problem persists, replace heading coupler
R accessory unit (Ref. 34-22-06).

R ---

R (12) Fault: On F/O ADI, command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Go to Step (b).

R No: Go to Step (d).

R (b) On Capt INSTRUMENT SOURCE SELECT panel, depress
R FLT DIR switchlight to illuminate ALTN legend. On
R Capt ADI, does command bar command right-roll?

R Yes: Replace heading coupler accessory unit (Ref.
R 34-22-06). If problem persists, replace F/O ADI
R (Ref. 34-21-07).

R No: Go to Step (c).

R (c) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT
R DIR switchlight to illuminate ALTN legend. On F/O
R ADI, does command bar command right-roll?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, replace HEADING/PITCH MODE
R panel (Ref. 22-10-03).

R No: Replace heading coupler accessory unit (Ref.
R 34-22-06).

R (d) On Capt INSTRUMENT SOURCE SELECT panel, depress
R FLT DIR switchlight to illuminate ALTN legend. On
R Capt ADI, does command bar command right-roll?

R Yes: Replace heading coupler accessory unit (Ref.
R 34-22-06). If problem persists, replace F/O ADI
R (Ref. 34-21-07).

R No: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, replace heading coupler
R accessory unit (Ref. 34-22-06).

R ---

R (13) Fault: On Capt ADI, no fault indication

R (a) Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (14) Fault: On F/O ADI, no fault indication

R (a) Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (15) Fault: On Capt ADI, command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).
RR If problem persists, check air data system No. 1
R for fault (Ref. 34-14-00).

R No: Go to Step (b).

R (b) On F/O INSTRUMENT SOURCE SELECT panel, depress FLT
RR DIR switchlight to illuminate ALTN legend. Does
R command bar on F/O ADI command right-roll?

R Yes: Replace heading coupler accessory unit (Ref.
RR 34-22-06). If problem persists, replace Capt ADI
R (Ref. 34-21-07).

R No: Replace roll computer No. 1 (Ref. 22-13-01).
RR If problem persists, replace heading coupler
R accessory unit (Ref. 34-22-06).

R ---

R (16) Fault: On F/O ADI, command bar motion incorrect

R (a) Does command bar remain in view?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).
RR If problem persists, check air data system No. 2
R for fault (Ref. 34-14-00).

R No: Go to Step (b).

R (b) On Capt INSTRUMENT SOURCE SELECT panel, depress
RR FLT DIR switchlight to illuminate ALTN legend. On
R Capt ADI, does command bar command right-roll?

R Yes: Replace heading coupler accessory unit (Ref.
RR 34-22-06). If problem persists, replace F/O ADI
R (Ref. 34-21-07).

R No: Replace roll computer No. 2 (Ref. 22-13-01).
RR If problem persists, replace heading coupler
R accessory unit (Ref. 34-22-06).

R ---

R (17) Fault: On Capt ADI, command bar motion incorrect

R (a) Replace roll computer No. 1 (Ref. 22-13-01). If
RR problem persists, check yaw system No. 1 for fault
R (Ref. 22-15-00).

R ---

R (18) Fault: On F/O ADI, command bar motion incorrect

R (a) Replace roll computer No. 2 (Ref. 22-13-01). If
R problem persists, check yaw system No. 2 for fault
R (Ref. 22-15-00).

R ---

R # FD NAV (VOR) MODE - FAULT ISOLATION

R 1. General

R The fault detection test procedure in Paragraph 4 is used in
R conjunction with the fault isolation procedure in Paragraph 5.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 5 for appropriate fault isolation.

R Figure 101 and 102 provide component location for FD NAV (VOR)
R Mode troubleshooting.

R 2. Equipment and Materials

R VOR/ILS Ramp Test Set T-30, or equivalent

R 3. Reference Procedures

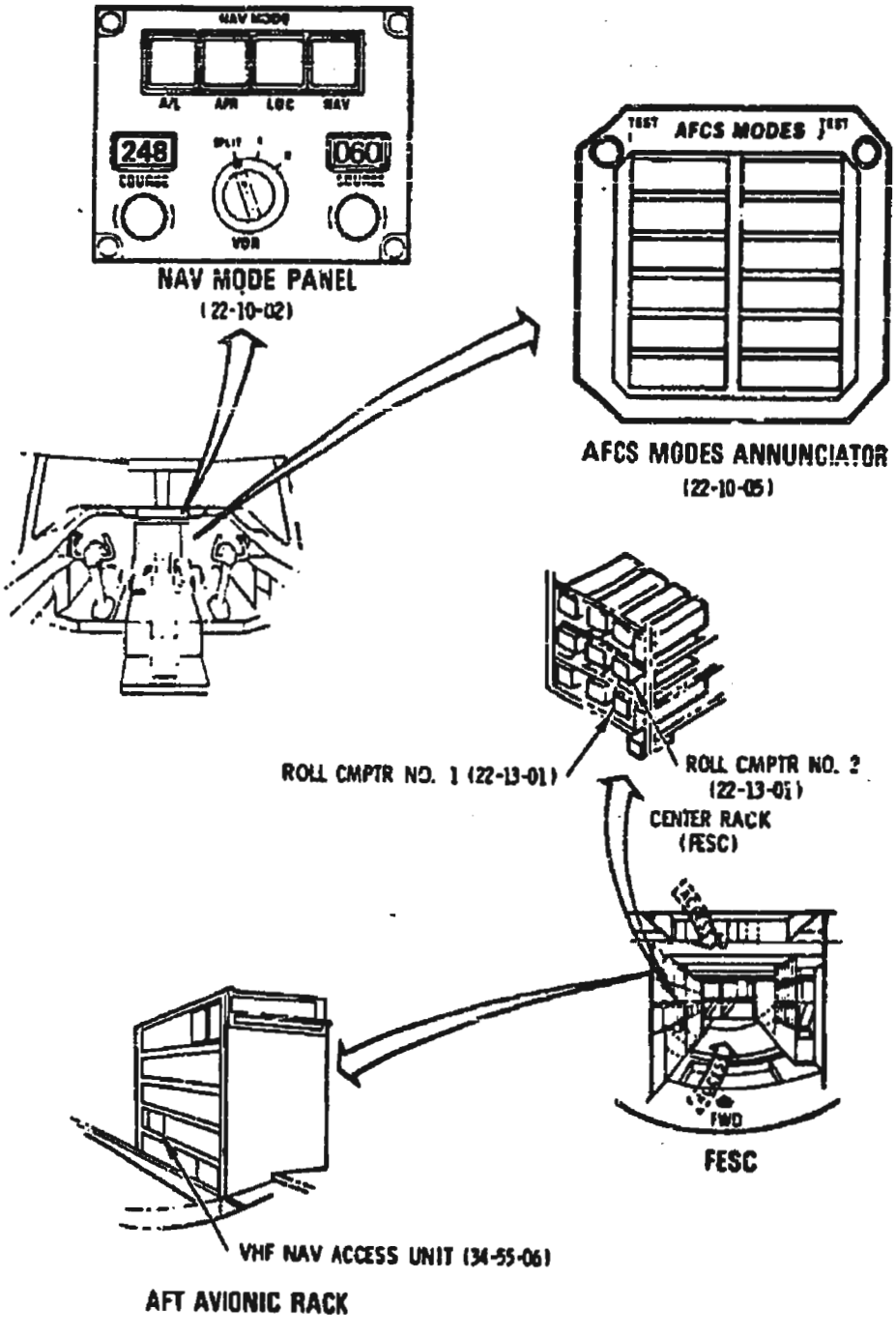
R	22-12-00	APFDS Modes of Operation - Maintenance Practices
R	22-12-01	AFCS Lamps and Annunciators - Fault Isolation
R	22-12-03	Flight Director Basic Mode - Fault Isolation
R R	22-12-15	Flight Director Heading Select Mode - Fault Isolation

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05
PANEL – NAVIGATION MODE SELECT	1	FLT STA, GLRSHLD PNL	22-10-02
UNIT – VHF NAVIGATION ACCESSORY	1	FESC, REAR RACK/112AB	34-55-05

M1-0000-22-2242

R R Component Location Index
Figure 101

R R 001B EFFECTIVITY: ALL



M1-0000-22-2243

R R Component Locator Diagram
Figure 102

R EFFECTIVITY: ALL
R R
001B

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00, maintenance
R practices.

R B. FD NAV (VOR) Mode Test

R (1) On APFDS ENGAGE panel, set both FD switches to ON.

R RESULT:

R Both ADI command bars come into view and are
R level.

R Both ADI FD flags are out of view.

R (2) On glareshield, set both VHF NAV frequency selectors to
R 108.0 MHz.

R (3) On VOR/ILS ramp test set, turn on VOR POWER switch
R (Ref. 34-33-00).

R (4) On VOR test set, adjust VOR for a 2 dot steer-right
R indication on both HSIs.

R (5) On NAV MODE panel, ensure that VOR switch is in SPLIT
R and depress NAV switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, VOR ARM messages
R are displayed.

R (6) On VOR test set, adjust VOR for a zero deviation
R indication on both HSIs.

R RESULT:

R On both AFCS MODES annunciators, VOR messages are
R displayed, and VOR ARM messages are removed within
R 1 minute.

R On both ADIs, FD flags are out of view, and
R command bars are centered and level.

R (7) On VOR test set, adjust VOR for a 2 dot steer-right
R indication on both HSIs.

R RESULT:

R On both ADIs, command bars indicate command right
R roll (allow 1 minute for command bars to respond).

R (8) Set both FD switches to OFF and then set FD A switch to
R ON.

R RESULT:

R On NAV MODE panel, NAV switchlight goes out.

R (9) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit
R breaker.

R (10) Depress NAV switchlight to on, and set VOR switch to 2.

R RESULT:

R On Capt AFCS MODE annunciator, VOR ARM message is
R displayed.

R (11) On NAV MODE panel, adjust right COURSE knob for a zero
R deviation indication on F/O HSI.

R RESULT:

R On Capt AFCS MODES annunciator, VOR message is
R displayed within one minute and VOR ARM message is
R removed.

R On Capt ADI, command bar is level.

R (12) Depress NAV switchlight to off.

R RESULT:

R VOR switch is driven to SPLIT.

R (13) On CB1, close NO. 2 SYSTEMS - PITCH & ROLL (A24)
R circuit breaker, and open NO. 1 SYSTEMS - PITCH & ROLL
R (A6) circuit breaker.

R (14) On APFDS ENGAGE panel, set FD A switch to OFF and FD B
R switch to ON.

R (15) Adjust right COURSE readout to aircraft heading.

R (16) Depress NAV switchlight to on, and set VOR switch to 1.

R RESULT:

R On F/O AFCS MODES annunciator, VOR ARM message is
R displayed.

R (17) On NAV MODE panel, adjust left COURSE knob for a zero
R deviation indication on Capt HSI.

R RESULT:

R On F/O AFCS MODES annunciator, VOR message is
R displayed and VOR ARM message is removed within
R one minute.

R On F/O ADI, command bar is level.

R (18) Depress NAV switchlight to off.

R RESULT:

R VOR switch is driven to SPLIT.

R (19) On CB1, close A6 circuit breaker.

R (20) On APFDS ENGAGE panel, set FD A switch to ON.

R (21) On NAV MODE panel, set left COURSE readouts to aircraft
R heading.

R (22) On VOR test set, adjust VOR for a zero deviation
R indication on both HSIs.

R (23) Depress NAV switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, VOR messages are
R displayed.

R (24) On NAV MODE panel, rapidly rotate left COURSE knob
R clockwise 40 degrees from aircraft heading.

R RESULT:

R On Capt ADI, command bar commands right roll.

R (Command bar starts to return to level within 2
R minutes.)

R (25) On NAV MODE panel, rapidly rotate right COURSE knob
R clockwise 40 degrees from aircraft heading.

R RESULT:

R On F/O ADI, command bar commands right roll.

R R (Command bar starts to return to level within 2 minutes.)

R (26) Set both COURSE readouts to aircraft heading.

R (27) Set both FD switches to OFF.

R (28) Turn off VOR POWER switch on VOR test set.

R 5. Fault Isolation

R A. General

R Table 101 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

R Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 102. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

R FD NAV (VOR) Mode Fault Isolation Summary
Table 101

TEST REF.	FAULT	FAULT NO.
4B(1)	ADI fault indication	(1)
4B(5)-1	VOR switch not at SPLIT position	(2)
4B(5)-2	NAV switchlight on NAV MODE panel not illuminated	(3)
4B(5)-3	VOR ARM message not displayed on Capt AFCS MODES annunciator	(4)
4B(5)-4	VOR ARM message not displayed on F/O AFCS MODES annunciator	(5)
4B(6)-1	VOR message not displayed on Capt AFCS MODES annunciator	(6)
4B(6)-2	VOR message not displayed on F/O AFCS MODES annunciator	(7)
4B(6)-3	FD flag displayed on Capt ADI	(8)
4B(6)-4	Command bar not level on Capt ADI	(9)
4B(6)-5	FD flag displayed on F/O ADI	(10)
4B(6)-6	Command bar not level on F/O ADI	(11)
4B(7)-1	Command bar does not move on Capt ADI	(12)
4B(7)-2	Command bar does not move on F/O ADI	(13)

FD NAV (VOR) Mode Fault Isolation Summary (Cont)
Table 101

TEST REF.	FAULT	FAULT NO.
4B(8)	NAV switchlight remains illuminated	(14)
4B(10)	VOR ARM message not displayed on Capt AFCS MODES annunciator	(15)
4B(11)-1	VOR message not displayed on Capt AFCS MODES annunciator	(16)
4B(11)-2	Command bar not level on Capt ADI	(17)
4B(12)-1	VOR switch remains in position 2 and NAV switchlight remains illuminated	(18)
4B(12)-2	VOR switch not driven to SPLIT position	(19)
4B(16)	VOR ARM message not displayed on F/O AFCS MODES annunciator	(20)
4B(17)-1	VOR message not displayed on F/O AFCS MODES annunciator	(21)
4B(17)-2	Command bar not level on F/O ADI	(22)
4B(20)-1	VOR switch remains in position 1 and NAV switchlight remains illuminated	(23)
4B(18)-2	VOR switch not driven to SPLIT position	(24)
4B(24)-1	Command bar does not move on Capt ADI	(25)
4B(24)-2	Command bar does not level on Capt ADI	(26)
4B(25)-1	Command bar does not move on F/O ADI	(27)
4B(25)-2	Command bar does not level on F/O ADI	(28)

Schematics for Fault Isolation of FD NAV (VOR) Mode Problem
Table 102

TITLE	LOCATION
Roll Systems No. 1 and No. 2 CMD Mode Signal Flow Schematic	22-13-00, Schem 5

R Schematics for Fault Isolation of FD NAV (VOR) Mode Problem (Cont)
R Table 102

TITLE	LOCATION
A/L,APR,LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7
HDG SEL, HDG Hold, Capture, A/L TRK-B and R-NAV Mode Engage Logic Schematic	22-13-00, Schem 8

R B. FD NAV (VOR) Mode Faults

R (1) Fault: ADI fault indication

R (a) Perform Steps (1) and (2) of FD basic mode test
R procedure (Ref. 22-10-31).

R ---

R (2) Fault: VOR switch not at SPLIT position

R (a) Can switch be manually set to SPLIT position?

R Yes: Continue test with switch at SPLIT position.

R No: Replace NAV MODE panel (Ref. 22-10-02).

R ---

R (3) Fault: On NAV MODE panel, NAV switchlight not
R illuminated

R (a) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated NAV
R switchlight fault?

R Yes: Replace NAV MODE panel (Ref. 22-10-02).

R No: Perform mode annunciation press-to-test fault
R isolation procedure (Ref. 22-02-01).

R ---

R (4) Fault: On Capt AFCS MODES annunciator, VOR ARM message
R not displayed

R (a) On Capt AFCS MODES annunciator, is VOR message
R displayed?

R Yes: Go to Step (c).

R No: Go to Step (b).

R (b) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated VOR
R ARM message fault?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).
R If problem persists, replace NAV MODE panel (Ref.
R 22-10-02). If problem persists, replace Capt AFCS
R MODES annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R (c) On Capt ADI, is FD flag displayed?

R Yes: Go to Step (d).

R No: Replace VHF NAV accessory unit (Ref.
R 34-55-06). If problem persists, replace roll
R computer No. 1 (Ref. 22-13-01).

R (d) On Capt HSI, is NAV flag displayed?

R Yes: Check VOR Navigation System for fault (Ref.
R 34-55-00).

R No: Replace VHF NAV accessory unit (Ref.
R 34-55-06).

R ----------

R (5) Fault: On F/O AFCS MODE annunciator, VOR ARM message
R not displayed

R (a) On F/O AFCS MODES annunciator, is VOR message
R displayed?

R Yes: Go to Step (c).

R No: Go to Step (b).

R (b) Can mode annunciation press-to-test procedure
R (Ref. 22-02-01) be performed with no indicated VOR
R ARM message fault?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).
R If problem persists, replace VHF NAV accessory
R unit (Ref. 34-55-06). If problem persists,
R replace F/O AFCS MODES annunciator (Ref.
R 22-10-05).

R No: Perform mode annunciation fault isolation
R procedure (Ref. 22-02-01).

R (c) On F/O ADI, is FD flag displayed

R Yes: Go to Step (d).

R No: Replace VHF NAV accessory unit (Ref.
R 34-55-06). If problem persists, replace roll
R computer No. 2 (Ref. 22-13-01).

R (d) On Capt HSI, is NAV flag displayed?

R Yes: Check VOR Navigation System for fault (Ref. R 34-55-00).

R No: Replace VHF NAV accessory unit (Ref. R 34-55-06).

R ---

R (6) Fault: On Capt AFCS MODES annunciator, VOR message not R displayed

R (a) Can mode annunciation press-to-test procedure R (Ref. 22-02-01) be performed with no indicated VOR R message fault?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01). R If problem persists, replace Capt AFCS MODES R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation R procedure (Ref. 22-02-01).

R ---

R (7) Fault: On F/O AFCS MODES annunciator, VOR message not R displayed

R (a) Can mode annunciation press-to-test procedure R (Ref. 22-02-01) be performed with no indicated VOR R message fault?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01). R If problem persists, replace F/O AFCS MODES R annunciator (Ref. 22-10-05).

R No: Perform mode annunciation fault isolation R procedure (Ref. 22-02-01).

R ---

R (8) Fault: On Capt ADI, FD flag displayed

R (a) On Capt HSI, is NAV flag displayed?

R Yes: Check VOR navigation system for fault (Ref. R 34-55-00).

R No: Go to Step (b).

R (b) On NAV MODE panel, set VOR switch to position 2.
R On Capt ADI, is FD flag removed from view?

R Yes: Replace VHF NAV accessory unit (Ref.
R 34-55-06).

R No: Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (9) Fault: On Capt ADI, command bar not level

R (a) On NAV MODE panel, set VOR switch to position 2.
R On Capt ADI, does command bar return to level?

R Yes: Replace NAV MODE panel (Ref. 22-10-02).

R No: Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (10) Fault: On F/O ADI, FD flag displayed

R (a) On F/O HSI, is NAV flag displayed?

R Yes: Check VOR navigation system for fault (Ref.
R 34-55-00).

R No: Go to Step (b).

R (b) On NAV MODE panel, set VOR switch to position 1.
R On F/O ADI, is FD flag removed from view?

R Yes: Replace VHF NAV accessory unit (Ref.
R 34-55-06).

R No: Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (11) Fault: On F/O ADI, command bar not level

R (a) On NAV MODE panel, set VOR switch to position 1.
R On F/O ADI, does command bar return to level?

R Yes: Replace NAV MODE panel (Ref. 22-10-02).

R No: Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (12) Fault: On Capt ADI, command bar does not move

R (a) Can FD heading select mode test procedure (Ref. R 22-13-31) be performed with no indicated fault?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).

R No: Perform FD heading select mode fault R isolation procedure (Ref. 22-13-31).

R ---

R (13) Fault: On F/O ADI, command bar does not move

R (a) Can FD heading select mode test procedure (Ref. R 22-13-31) be performed with no indicated fault?

R Yes: Replace roll computer No. 2 (Ref. 22-13-01).

R No: Perform FD heading select mode fault R isolation procedure (Ref. 22-13-31).

R ---

R (14) Fault: On NAV MODE panel, NAV switchlight remains R illuminated

R (a) Can Steps (1) and (2) of FD test procedures be R performed with no indicated faults?

R Yes: Go to Step (b).

R No: Perform fault isolation procedure for steps R (1) and (2) of FD basic mode test procedure (Ref. R 22-10-31).

R (b) On Capt AFCS MODES annunciator, is VOR message R displayed?

R Yes: Replace roll computer No. 1 (Ref. 22-13-01).

R No: Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (15) Fault: On Capt AFCS MODES annunciator, VOR ARM message R not displayed

R (a) Replace VHF NAV accessory unit (Ref. 34-55-06).

R ---

R (16) Fault: On Capt AFCS MODES annunciator, VOR message not R displayed

R (a) Replace VHF NAV accessory unit (Ref. 34-55-06).

R ---

R (17) Fault: On Capt ADI, command bar not level

R (a) Replace NAV MODE panel (Ref. 22-10-02).

R ---

R (18) Fault: On NAV MODE panel, VOR switch remains in
R position 2 and NAV switchlight remains illuminated

R (a) Replace roll computer No. 1 (Ref. 22-13-01). If
R problem persists, replace NAV MODE panel (Ref.
R 22-10-02).

R ---

R (19) Fault: On NAV MODE panel, VOR switch not driven to
R SPLIT position

R (a) Replace NAV MODE panel (Ref. 22-10-02).

R ---

R (20) Fault: On F/O AFCS MODES annunciator, VOR ARM message
R not displayed

R (a) Replace VHF NAV accessory unit (Ref. 34-55-06).

R ---

R (21) Fault: On F/O AFCS MODES annunciator, VOR message not
R displayed

R (a) Replace VHF NAV accessory unit (Ref. 34-55-06).

R ---

R (22) Fault: On F/O ADI, command bar not level

R (a) Replace NAV MODE panel (Ref. 22-10-02).

R ---

R (23) Fault: On NAV MODE panel, VOR switch remains in
R position 1 and switchlight remains illuminated

R (a) Replace roll computer No. 2 (Ref. 22-13-01). If
R problem persists, replace NAV MODE panel (Ref.
R 22-10-02).

R ---

R (24) Fault: On NAV MODE panel, VOR switch not driven to
R SPLIT position

R (a) Replace NAV MODE panel (Ref. 22-10-02).

R ---

R (25) Fault: On Capt ADI, command bar does not move

R (a) On NAV MODE panel, set VOR switch to position 2.
R Rapidly rotate right COURSE knob clockwise 40
R degrees from aircraft heading. On Capt ADI, does
R command bar command right-roll?

R Yes: Replace VHF NAV accessory unit (Ref.
R 34-55-06). If problem persists, replace NAV MODE
R panel (Ref. 22-10-02).

R No: Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (26) Fault: On Capt ADI, command bar does not level

R (a) Replace roll computer No. 1 (Ref. 22-13-01).

R ---

R (27) Fault: On F/O ADI, command bar does not move

R (a) On NAV MODE panel, set VOR switch to position 1.
R Rapidly rotate the left COURSE knob clockwise 40
R degrees from aircraft heading. On F/O ADI, does
R command bar command right-roll?

R Yes: Replace VHF NAV accessory unit (Ref.
R 34-55-06). If problem persists, replace NAV MODE
R panel (Ref. 22-10-02).

R No: Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R (28) Fault: On F/O ADI, command bar does not level

R (a) Replace roll computer No. 2 (Ref. 22-13-01).

R ---

R # AUTOLAND MODE (TOTAL SEQUENCE) - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting AUTOLAND Mode (Total Sequence) faults are included in this section of the manual. An AUTOLAND Mode malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use Figure 103.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Identification

R Table 101 is a list of the AUTOLAND Mode (Total Sequence) fault isolation diagrams and schematics. Figure 101 and 102 provide component location for AUTOLAND Mode troubleshooting.

R A. General

R AUTOLAND mode (total sequence) fault isolation contains two levels of troubleshooting: (1) fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 2B) trouble shoots a specific AUTOLAND problem. System oriented fault isolation (Ref. 22-14-31, Page 501) tests and trouble shoots general AUTOLAND problems.

R B. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the autoflight system by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in Figure 103, perform test (Ref. 22-14-31, Page 501) to isolate problem.

R Figures 104 through 111 provide diagnostic steps to further
R isolate the fault. The diagnostic steps are in flow chart
R form which contains complete fault isolation procedures for
R each fault. Action instructions are contained within the
R blocks of the flow chart while the monitored results of the
R actions are outside the blocks. When using the flow charts,
R it is assumed that systems are in the normal operational
R mode, all relevant circuit breakers have been checked, and
R all applicable aircraft operational procedures have been
R accomplished.

R Figures 104 through 111 contain only the fault isolation for
R faults peculiar to the A/L modes (see Figure 103 for
R AUTOLAND overview). These faults are hidden in all
R autopilot modes except autoland. Fault isolation procedures
R for faults which can be detected or isolated prior to A/L
R are not duplicated if the particular fault occurs during
R A/L. Refer to 22-INDEX for the fault isolation procedure
R when an AP, FD, DANA, YAW SAS or other related fault is
R observed during testing prior to A/L.

R TABLE 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	AUTOLAND Fault Identification
104	A/L Mode Engagement Faults
105	A/L LOC Capture Mode Faults
106	A/L GS Capture Mode Faults
107	A/L Track Mode Faults
108	A/L ALIGN Mode Faults
109	A/L FLARE Mode Faults
110	A/L ROLLOUT Mode Faults
111	A/L Touchdown to Ramp Faults

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCELEROMETER – LATERAL	1	GALY CLG/135DB	22-13-02
ACCELEROMETER – NORMAL	1	GALY CLG/135DB	22-11-02
COMPUTER – FLIGHT CONTROL ELECTRONICS SYSTEM	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – SPEED CONTROL	1	FESC, CTR RACK/112AB	22-31-07
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
CONTROL BOX – INDICATOR LIGHTS	1	FESC, AFT OF ELEC RACK/112AB	33-17-04
COUPLER – COMPASS	2	FESC, REAR RACK/112AB	34-22-03
PANEL – AP FDS ENGAGE	1	FLT STA, GLRSHLD PNL	22-10-01
PANEL – NAVIGATION MODE SELECT	1	FLT STA, GLRSHLD PNL	22-10-02
PANEL – VHF NAV CONTROL	2	FLT STA, GLRSHLD PNL	34-56-02
RECEIVER – ILS	2	FESC, REAR RACK/112AB	34-33-01
SERVO MODULE – RUDDER	1	VERT STAB/324AL, 324AR	27-21-07
SWITCH – AP A(B) HYD SYS B(A) PRESS	2	VERT STAB, ON RUDDER SERVO MDL/324AL, 324AR	27-21-24
SWITCHLIGHTS – SQUARE (RELAMPING)		FLT STA	20-33-01
TRANSDUCER – LEFT INBOARD AILERON DUAL POSITION	2	LEFT WING/551AB	22-13-03
TRANSDUCER – RUDDER DUAL POSITION	2	VERT STAB/324CL, 325DL	22-15-03
TRANS/REC – RADIO ALTIMETER	2	MESC, L AND R RACK/131AR	34-32-01
VALVE – AP A(B) HYD SYS B(A) SHUTOFF	2	VERT STAB, ON RUDDER SERVO MDL/324AL, 324AR	27-21-08

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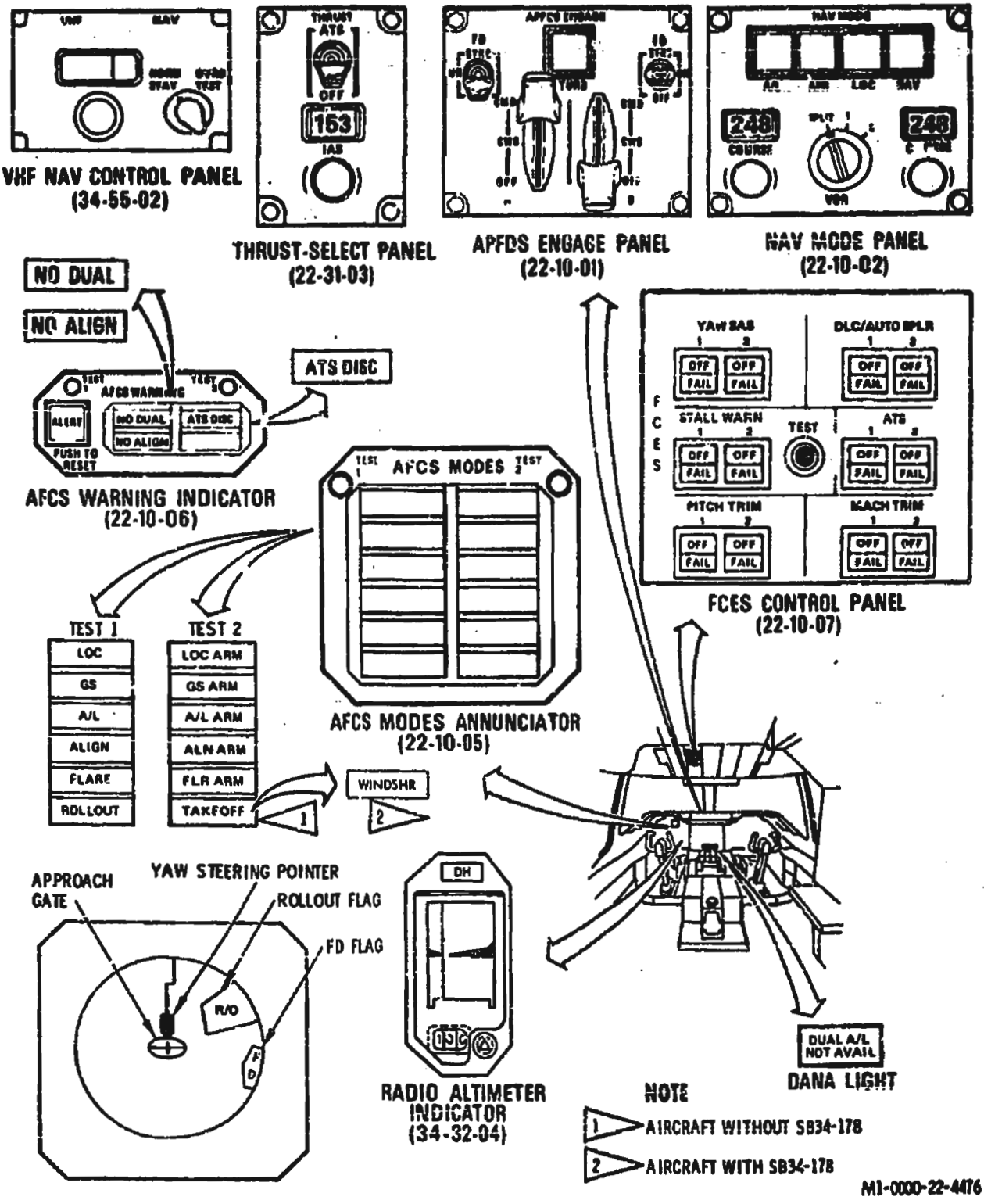
R Component Location Index
R Figure 101

R EFFECTIVITY: ALL
R
0018

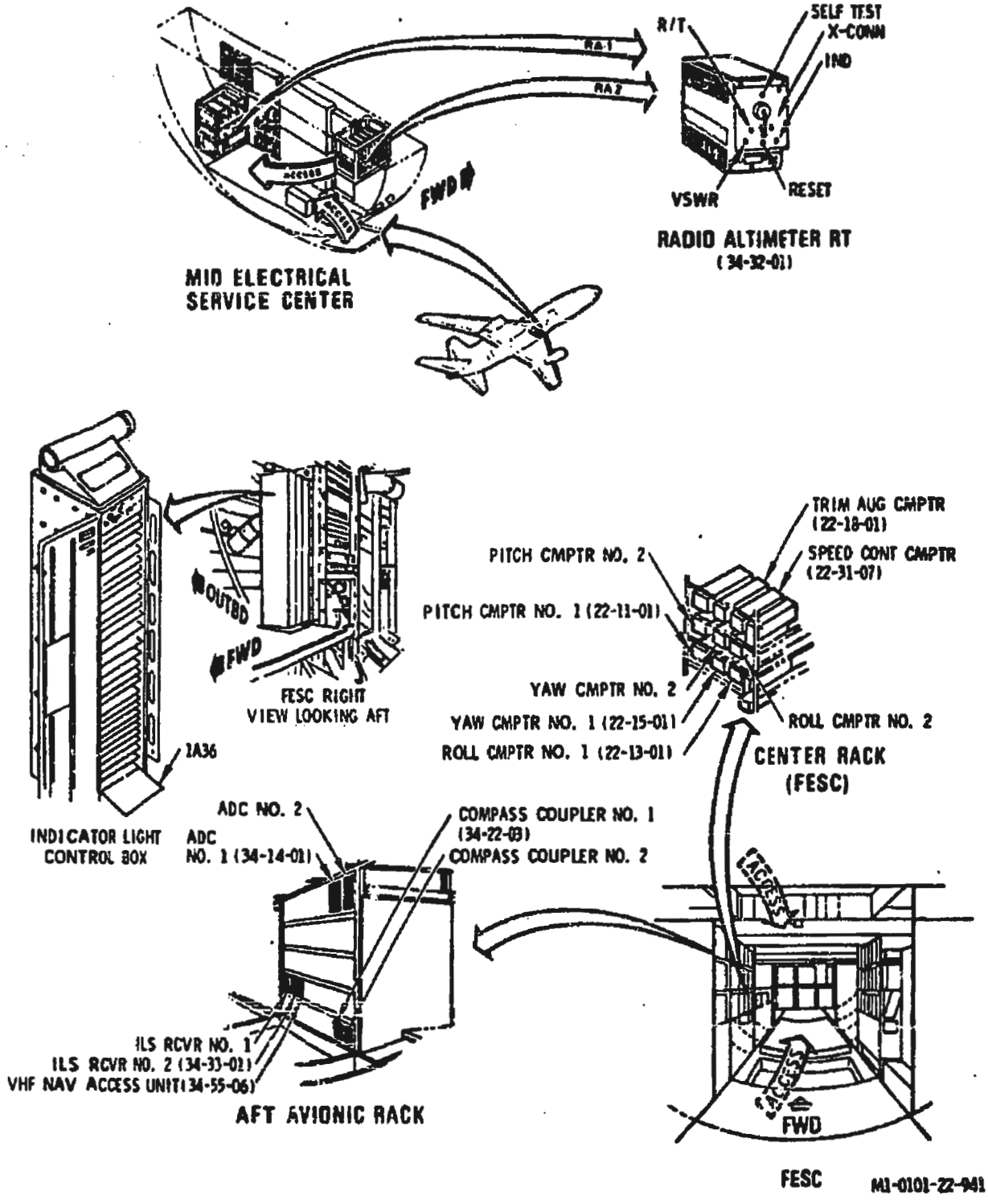


R
R

Component Locator Diagram
Figure 102 (Sheet 1)

EFFECTIVITY: ALL

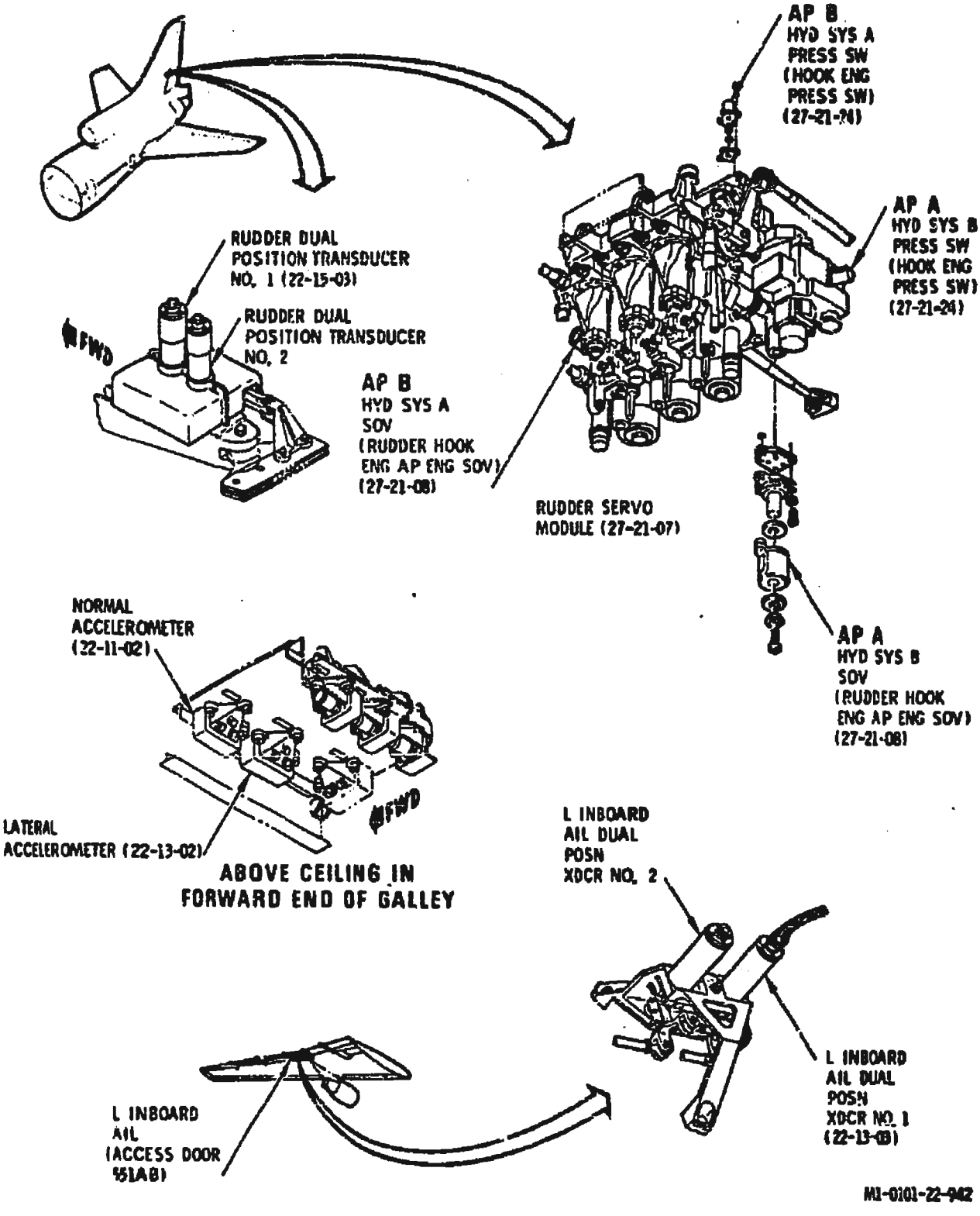
001B



Component Locator Diagram
Figure 102 (Sheet 2)

EFFECTIVITY: ALL

001B



Component Locator Diagram
Figure 102 (Sheet 3)

EFFECTIVITY: ALL

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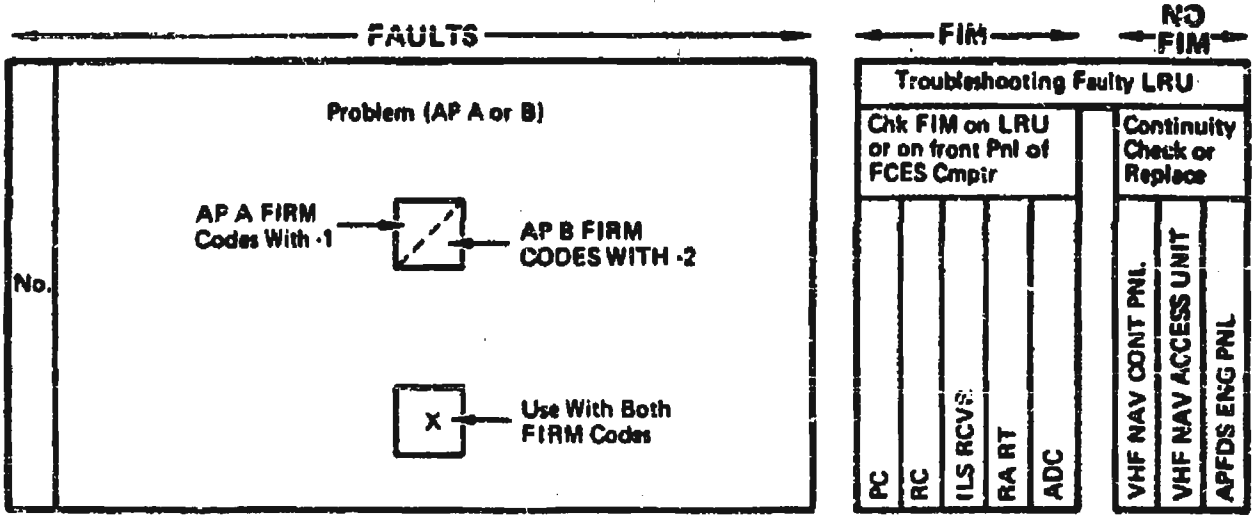

"A/L MODE ENGAGEMENT FAULT" (REF. FIG. 104)

No.	Problem (AP A or B)	PC	RC	ILS RCVR	RA RT	ADC	VHF NAV CONT PNL	VHF NAV ACCESS UNIT	APFDS ENG PNL
1	During A/L engagement, one message (LOC ARM,GS ARM, A/L ARM) did not appear (blank) on Capt (F/O) AFCS MODES ann. Message came on during AFCS MODES ann TEST 2.	1/2	1/2						
2	During A/L engagement, only GS ARM message was displayed on Capt (F/O) AFCS MODES ann. Other ann display was normal (LOC ARM, GS ARM, A/L ARM). Messages came on during AFCS MODES ann TEST 2.	1/2	1/2						
3 ⚠1	During A/L engagement, LOC message is displayed as soon as A/L sw it is depressed. AP Commands a maneuver to center on LOC beam (as shown on HSI) when AP A (B) was engaged FIRST.		1/2	1/2					
4	During A/L engagement, LOC message is displayed as soon as A/L sw it is depressed. AP does NOT command a maneuver to center on LOC beam (as shown on HSI) when AP A (B) was engaged FIRST.		1/2	1/2					
5	During A/L engagement, a FD flag comes into view on Capt (F/O) ADI as soon as A/L sw it is depressed. AP bat handle (same side) drops to CWS if engaged FIRST. If bat handle (same side) is engaged SECOND, it drops to OFF when released. Radio alt flag in-view (same side). DANA light comes on immediately after AP bat handle it set to CWS from OFF ⚠2.				1/2				
6	During A/L engagement, a FD flag comes into view on Capt (F/O) ADI as soon as A/L sw it is depressed. AP bat handle (same side) drops to CWS if engaged FIRST. If bat handle (same side) is engaged SECOND, it drops to OFF when released. No other cockpit indications.	1/2			1/2	1/2			
7	During A/L engagement, AP A (B) bat handle drops to CWS. FD flag comes into view on ADI (same side). [Both VHF NAV control panels are tuned to ILS freq.] When other bat handle is engaged FIRST, A/L engagement is normal.		1/2				1/2	X	
8	During AUTOLAND engagement, A/L light did not come on. All other cockpit indications normal.		1/2						X

NOTE

⚠1 Fault 3 will not occur when roll cmptr modified by Collins SB-38 are used.

⚠2 DANA light does not come on when pitch cmptr modified by Collins SB-37 are used.

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R AUTOLAND Fault Matrix
R Figure 103 (Sheet 1)

R EFFECTIVITY: ALL

R

001B

No.	FAULTS — Problem (AP A or B)	FIM — Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: PC	RC	YC	ILS RCVR	NO FIM — Troubleshooting Faulty LRU: Continuity Check or Replace: NAV MODEPNL	COMP COUPLER
	AP A FIRM Codes With -1 / AP B FIRM Codes With -2						
	[X] Use with both FIRM Codes						
	"A/L-LOC CAPTURE FAULTS" (REF. FIG. 105)						
11	During AUTOLAND (at least 30 sec after LOC capture but prior to A/L message), NO ALIGN message is displayed. After A/L message, ALIGN ARM, ALIGN and ROLLOUT messages were not displayed on AFCS MODES ann. ADI yaw steering pointers do not come in-view at ROLLOUT.			1/2		X	X
12	During AUTOLAND at LOC capture, Capt (F/O) AFCS MODES ann indicates LOC, other ann indicates LOC ARM.		1/2				
13	During AUTOLAND at LOC capture, Capt (F/O) AFCS MODES ann indicates LOC, other ann blank. Message comes in-view during AFCS MODES ann TEST 1.		1/2				
14 (1)	During AUTOLAND at LOC capture, GS message is displayed immediately, AP commands a maneuver to center on GS beam (as shown on HSI) when AP A (B) was engaged FIRST.	1/2			1/2		
15	During AUTOLAND at LOC capture, GS message is displayed immediately, AP does not command a maneuver to center on GS beam (as shown on HSI).	1/2			1/2		
16 (2)	During AUTOLAND after LOC capture, AP A(B) bat handle drops to OFF and ADI (same side) has FD flag in-view. NO DUAL message at A/L capture. --- DANA light came on immediately after AP bat handle was set to CWS from OFF with VOR freq. selected. When ILS freq. selected, LOC flags appeared on HSI (same side).				1/2		
17 (2)	During AUTOLAND after LOC capture, AP A (B) bat handle drops to OFF and ADI (same side) has FD flag in-view. NO DUAL message at A/L capture. --- DANA light came on immediately after AP bat handle was set to CWS from OFF with VOR freq. selected.		1/2		1/2		

NOTE

(1) Fault 14 will not occur when pitch cmptr with Collins SB37 are used

(2) DANA light does not come on when roll cmptr with Collins SB38 are used

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R AUTOLAND Fault Matrix
R Figure 103 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

FAULTS — FIM — NO FIM

No.	PROBLEM (AP A or B)	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr — PC	SCC	ILS RCVR	YC	Continuity Check or Replace — ADI
	AP A FIRM Codes With -1 / AP B FIRM Codes With -2 / X — Use With Both FIRM Codes					
	"A/L-GS CAPTURE FAULTS" (REF. FIG. 106)					
21	During AUTOLAND at GS capture, NO GA message comes into view on AFCS warning ind. No other cockpit indications		X			
22	During AUTOLAND at GS capture, Capt (F/O) AFCS MODES ann indicates GS, other ann indicates GS ARM	1/2				
23	During AUTOLAND at GS capture, Capt (F/O) AFCS MODES ann indicates GS, other ann blank. Message comes in-view during AFCS ann TEST 1	1/2				
24	During AUTOLAND after GS capture, AP A(B) bat handle drops to OFF and ADI (same side) has FD flag in-view. NO DUAL message at A/L capture — — /1\ DANA light came on immediately after AP bat handle was set to CWS, from OFF with VOR freq selected. When ILS freq was selected, GS flag appeared on HSI (same side)			1/2		
25	During AUTOLAND after GS capture, AP A(B) bat handle drops to OFF and ADI (same side) has FD flag in-view. NO DUAL message at A/L capture — — /2\ DANA light comes on after GS capture	1/2		1/2		
26	During AUTOLAND at GS capture, Capt (F/O) approach gate did NOT come in-view	1/2			1/2	C/F

NOTE

/1\ DANA light does not come on when roll cmptr with Collins SB38 are used
/2\ DANA light does not come on when pitch cmptr Collins SB37 are used

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AUTOLAND Fault Matrix
Figure 103 (Sheet 3)

EFFECTIVITY: ALL

0018

FAULTS		FIM								NO FIM						
		Troubleshooting Faulty LRU														
		Check FIM on LRU or on Front Panel of FCES Cmptr								Continuity Check or Replace						
No.	Problem (AP A or B)	PC	RC	YC	RA RT	ILS RCVR	LA	NA	RUD SERVO	RUD SERVO AP SOV	RUD SERVO AP PRESS SW	RUD POSN XDCR	AIL POSN XDCR	APFDS ENG PNL	22-16-00, Fault 1 and 4	22-12-37, Fault 11
	AP A FIRM Codes With -1 — AP B FIRM Codes With -2															
	X — Use With Both FIRM Codes															
"A/L TRACK FAULTS" (Ref. Fig. 107)																
31	During AUTOLAND at A/L track capture, Capt (F/O) AFCS MODES ann indicates A/L, other ann blank. Correct message during AFCS MODES ann TEST 1		1/2													
32	During AUTOLAND at A/L track capture, Capt (F/O) AFCS MODES ann indicates ALN ARM, other ann blank. Correct message during AFCS MODES ann TEST 2			1/2												
33	During AUTOLAND at A/L track capture, Capt (F/O) AFCS MODES ann indicates FLR ARM, other ann blank. Correct message during AFCS MODES ann TEST 2	1/2														
33 A	During AUTOLAND ground test at A/L track. NO DUAL message is displayed and LATCHED DANA is displayed. No other cockpit indications															X
34	During AUTOLAND at A/L track and above 156 feet, both ALIGN ARM messages came in-view instead of ALN ARM messages			1/2												
35	During AUTOLAND at A/L track, NO DUAL message is displayed. YAW SAS 1 or 2 FAIL light on. (LATCHED DANA)			1/2								1/			X	
36	During AUTOLAND at A/L track, NO DUAL message is displayed. No other cockpit indications. (LATCHED DANA)	1/2	1/2	1/2	1/2	1/2				A/B	A/B		1/2	X		
37	During AUTOLAND at A/L track, NO DUAL message is displayed. FD flag in-view on Capt (F/O) ADI after A/L track. One FLR ARM message on AFCS MODES ann (same side) blank. Radio alt (same side) read less than 50 FT (LATCHED DANA)				1/2											
38	During AUTOLAND at A/L track, NO DUAL message is displayed, FD flag in-view on Capt (F/O) ADI after A/L track. One FLR ARM message on AFCS MODES ann (same side) blank. (LATCHED DANA)		1/2													

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AUTOLAND Fault Matrix
Figure 103 (Sheet 4)

EFFECTIVITY: ALL

FAULTS		FIM						NO FIM	
No.	Problem (AP A or B) AP A FIRM Codes With -1 AP B FIRM Codes With -2 X = Use With Both FIRM Codes	Troubleshooting Faulty LRU Check FIM on LRU or on Front Panel of FCES Cmptr PC	RC	YC	TAC	RA RT	ILS RCVR	Continuity Check or Replace See Fig 105, Fault 41	See Fig. 105, Fault 42
"A/L TRACK FAULTS CONT" (Ref. Fig. 107)									
39	During AUTOLAND at A/L track, NO DUAL message is displayed. FD flag in-view on Capt (F/O) ADI after A/L track. (LATCHED DANA)	1/2	1/2			1/2	1/2		
40	During AUTOLAND at A/L track, NO DUAL message is displayed. FD flags in-view on both ADI after A/L track (LATCHED DANA)	1/2	1/2						
41	During AUTOLAND, AP A (B) disconnect during A/L track. NO DUAL message is displayed (LATCHED DANA)	1/2	1/2					X	
42	During AUTOLAND, both AP disconnect during A/L track								X
43	During AUTOLAND, A/L capture above 1500 ft radio alt 30 sec after GS capture. At A/L track both ALIGN messages in-view and CAPT (F/O) FLR ARM message was blank on AFCS MODES ann. FD flags in-view on both ADI. If in ATS mode, throttles retard at A/L track. (LATCHED DANA.)						1/2		
44	During AUTOLAND, A/L capture above 1500 ft radio alt 30 sec after GS capture. At A/L track, NO DUAL message is displayed, and FLR ARM message was blank on Capt (F/O) AFCS MODES ann. FD flags in-view on both ADI (LATCHED DANA)	1/2							
45	During AUTOLAND after A/L capture PITCH TRIM 1 (2) FAIL light came on. FLT CONT PANELS light come on. No other cockpit indications				X				
46	During AUTOLAND at A/L track, NO DUAL message is displayed. FD flag in-view on Capt (F/O) ADI after A/L track. Yaw steering pointer on ADI (same side) did not come in-view at ROLLOUT. (LATCHED DANA)		1/2	1/2		1/2			

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R R AUTOLAND Fault Matrix
Figure 103 (Sheet 5)

R R 001B EFFECTIVITY: ALL

FAULTS			FIM				NO FIM		
No.	Problem (AP A or B)		Troubleshooting Faulty LRU						
			Check FIM on LRU or on front Panel of FCES Cmptr				Continuity Check or Replace		
	AP A FIRM Codes With -1 / AP B FIRM Codes With -2	X = Use With Both FIRM Codes	PC	RC	YC		See Fig. 106, Fault 56	See Fig. 106, Fault 57	
"A/L ALIGN MODE FAULTS" (Ref. Fig 108)									
51	During AUTOLAND at ALIGN, Capt (F/O) AFCS MODES ann indicates ALIGN, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 1.				1/2				
52	During AUTOLAND, NO ALIGN message came in-view after ALIGN.				1/2				
53	During AUTOLAND at ALIGN, NO DUAL message is displayed. (LATCHED DANA).			1/2	1/2				
54	During AUTOLAND at ALIGN, NO DUAL message is displayed. Capt (F/O) AFCS MODES ann indicates ALIGN, other ann blank. Yaw steering pointer (same side ADI) out-of-view (LATCHED DANA).				1/2				
55	During AUTOLAND, AP A (B) disconnect during ALIGN or FLARE or ROLLOUT. DANA recall.		1/2	1/2			X		
56	During AUTOLAND, both AP disconnect during ALIGN or FLARE or ROLLOUT.							X	

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R R AUTOLAND Fault Matrix
Figure 103 (Sheet 6)

R R EFFECTIVITY: ALL

001B

FAULTS		FIM			NO FIM
No.	Problem (AP A or B)	Troubleshooting Faulty LRU			
	AP A FIRM Codes With -1 / AP B FIRM Codes With -2 / X Use With Both FIRM Codes	Check FIM on LRU or on front Panel of FCES Cmptr			Continuity Check or Replace
		PC	SC		
"A/L FLARE MODE FAULTS" (Ref. Fig. 109)					
61	During AUTOLAND at FLARE, ATS DrSC message and both ATS FAIL lights on.		X		
62	During AUTOLAND at FLARE, Capt (F/O) AFCS MODES ann indicates FLARE, other ann blank. Correct message comes in-view during AFCS MODES ann TEST 1. DANA RECALL.	1/2			
63	During AUTOLAND at FLARE, Capt (F/O) AFCS MODES ann indicates FLARE, other ann blank. Correct message comes in-view during AFCS MODES on TEST 1. No other cockpit indications.	1/2			
64	During AUTOLAND at FLARE, Capt (F/O) AFCS MODES ann indicates FLARE, other ann blank and then indicates FLARE approx. 5 ft lower than flare altitude. DANA RECALL.	1/2			

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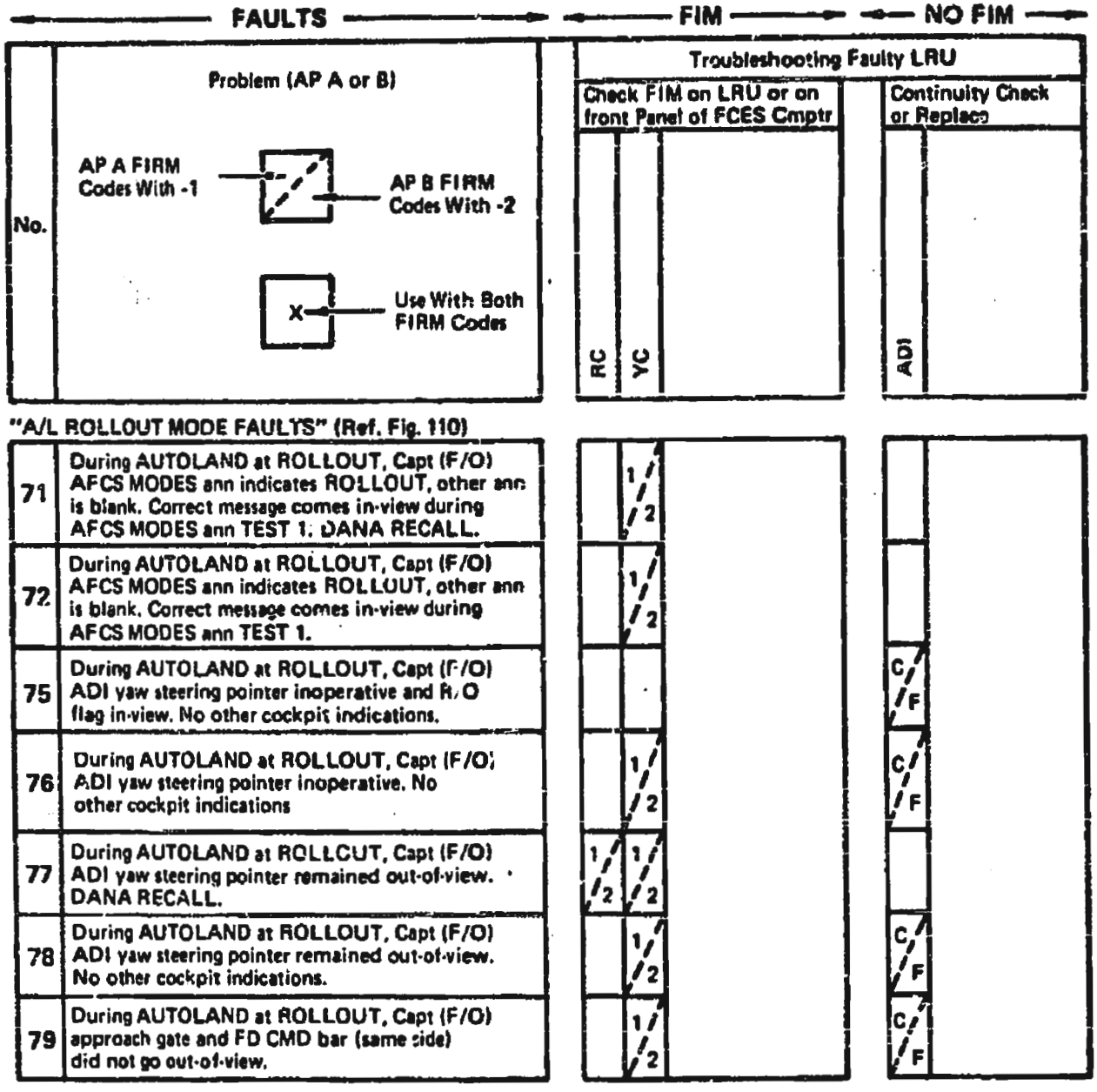
R AUTOLAND Fault Matrix
R Figure 103 (Sheet 7)

R EFFECTIVITY: ALL
R
001B


FAULTS
FIM
NO FIM
No.
Problem (AP A or B)
AP A FIRM Codes With -1
AP B FIRM Codes With -2
X
Use With Both FIRM Codes
Troubleshooting Faulty LRU
Check FIM on LRU or on front Panel of FCES Cmptr
Continuity Check or Replace
RC
YC
ADI
"A/L ROLLOUT MODE FAULTS" (Ref. Fig. 110)
71 During AUTOLAND at ROLLOUT, Capt (F/O) AFCS MODES ann indicates ROLLOUT, other ann is blank. Correct message comes in-view during AFCS MODES ann TEST 1. DANA RECALL.
72 During AUTOLAND at ROLLOUT, Capt (F/O) AFCS MODES ann indicates ROLLOUT, other ann is blank. Correct message comes in-view during AFCS MODES ann TEST 1.
75 During AUTOLAND at ROLLOUT, Capt (F/O) ADI yaw steering pointer inoperative and R/O flag in-view. No other cockpit indications.
76 During AUTOLAND at ROLLOUT, Capt (F/O) ADI yaw steering pointer inoperative. No other cockpit indications
77 During AUTOLAND at ROLLOUT, Capt (F/O) ADI yaw steering pointer remained out-of-view. DANA RECALL.
78 During AUTOLAND at ROLLOUT, Capt (F/O) ADI yaw steering pointer remained out-of-view. No other cockpit indications.
79 During AUTOLAND at ROLLOUT, Capt (F/O) approach gate and FD CMD bar (same side) did not go out-of-view.

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R AUTOLAND Fault Matrix
R Figure 103 (Sheet 8)

R EFFECTIVITY: ALL
R
001B

No.	Problem (AP A or B)	Troubleshooting Faulty LRU: Check FIM on LRU or on front Panel of FCES Cmptr: PC	RC	YC	SC	FCES	NO FIM: Continuity Check or Replace: 1A36 CARD (ILCB)	22-12-37, Faulty 11
	AP A FIRM Codes With -1 ← / → AP B FIRM Codes With -2; X ← Use With Both FIRM Codes							
"A/L TOUCHDOWN TO RAMP" (Ref. Fig. 111)								
91	During AUTOLAND at ROLLOUT, nose is slow getting down to ground. DANA RECALL.	1/2						
92	During AUTOLAND at ROOLOUT, nose is slow getting down to ground. No other cockpit indications.					X		
93	During AUTOLAND at TOUCHDOWN, ATS DISC message with both ATS FAIL lights on. No other cockpit indications.				X			
94	During AUTOLAND at TOUCHDOWN, Capt (F/O) ATS DISC message after throt retard to idle position and ATS switch drops to OFF.				X			
95	DANA RECALL. No other cockpit indications.	1/2	1/2	1/2				X
96	DANA light on with both AP turned off. DANA will not reset.		1/2				X	

M1-0002-22-831

AUTOLAND Fault Matrix
Figure 103 (Sheet 9)

EFFECTIVITY: ALL

Abbreviations		Remove and Install Ref.	
		Chapt	Page
ADC	Air Data Computer	34-14-01	401
ADI	Attitude Director Indicator	34-21-07	401
AIL POSN XDCR	Left Inboard Aileron Dual Position Transducer	22-13-03	401
APFDS ENG PNL	APFDS Engage Panel	22-10-01	401
COMP COUPLER	Compass Coupler	34-22-03	401
ILCB CARD	Indicator Lights Control Box Card	33-17-04	401
ILS RCVR	ILS Receiver	34-33-01	401
LA	Lateral Accelerometer	22-13-02	401
NA	Normal Accelerometer	22-11-02	401
NAV MODE PNL	Navigation Mode Panel	22-10-02	401
PC	Pitch Computer	22-11-01	401
RA RT	Radio Altimeter RT	34-32-01	401
RC	Roll Computer	22-13-01	401
RUD SERVO	Rudder Servo Module	27-21-07	401
RUD SERVO AP PRESS SW	Rudder Servo Autopilot Servo Pressure Sw	27-21-24	401
RUD SERVO AP SOV	Rudder Servo Autopilot Shutoff Valve	27-21-09	401
RUD PUSH XDCR	Rudder Dual Position Transducer	22-15-03	401
SC	Speed Control Computer	22-31-07	401
TAC	Trim Augmentation Computer	22-18-01	401
VHF NAV ACCESS UNIT	VHF NAV Accessory Unit	34-55-06	401
VHF NAV CONTROL PNL	VHF NAV Control Panel	34-55-02	401
YC	Yaw Computer	22-15-01	401
X	One LRU Common to Both Sys		
1 or A or C (Capt)	No. 1 LRU Associated with Sys 1 Problem		
2 or B or F (F/O)	No. 2 LRU Associated with Sys 2 Problem		
3	No. 3 LRU Common to Both Sys		

HOW TO USE

1. Find flight squawk in FAULTS column.
2. Check FIM or LRU listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU.
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 105 thru 111.

HOW TO RESET DANA RECALL

1. Turn off both FD and both AP.
2. On CB 1, open then close 1A6 and 1A24 CB.
   DANA light goes out when AP is turned OFF.
   If DANA remains on with AP OFF, go to FAULT 96.

M1-0001-22-943

R AUTOLAND Fault Matrix
R Figure 103 (Sheet 10)

R EFFECTIVITY: ALL
R
001B

DANA/NO DUAL STORY

AP on prior to A/L – DANA arms. NO DUAL not active.

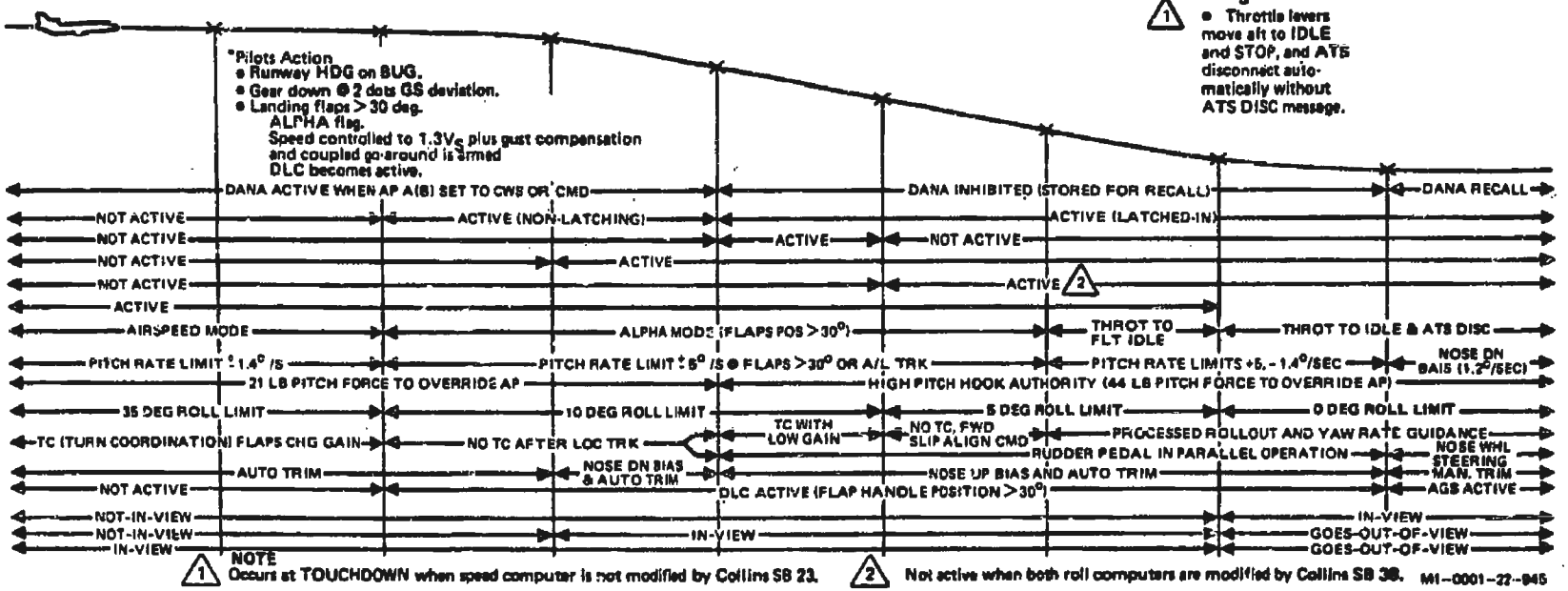
A/L until ALIGN – NO DUAL active and sets DANA latch. DANA inhibited. If DANA at A/L, it remains on and forces NO DUAL.

ALIGN until ROLLOUT – DANA and NO DUAL inhibited but stored by DANA latch. A latched DANA warning comes on when aircraft slows below 80 knots or AP is disconnected after A/L track. A latched DANA can only be reset by recycling 1AB and 1A24 CB or when aircraft power is removed.

DANA RECALL warning – when DANA warning is latched on after aircraft arrives at the ramp and pilot does not report a NO DUAL warning.

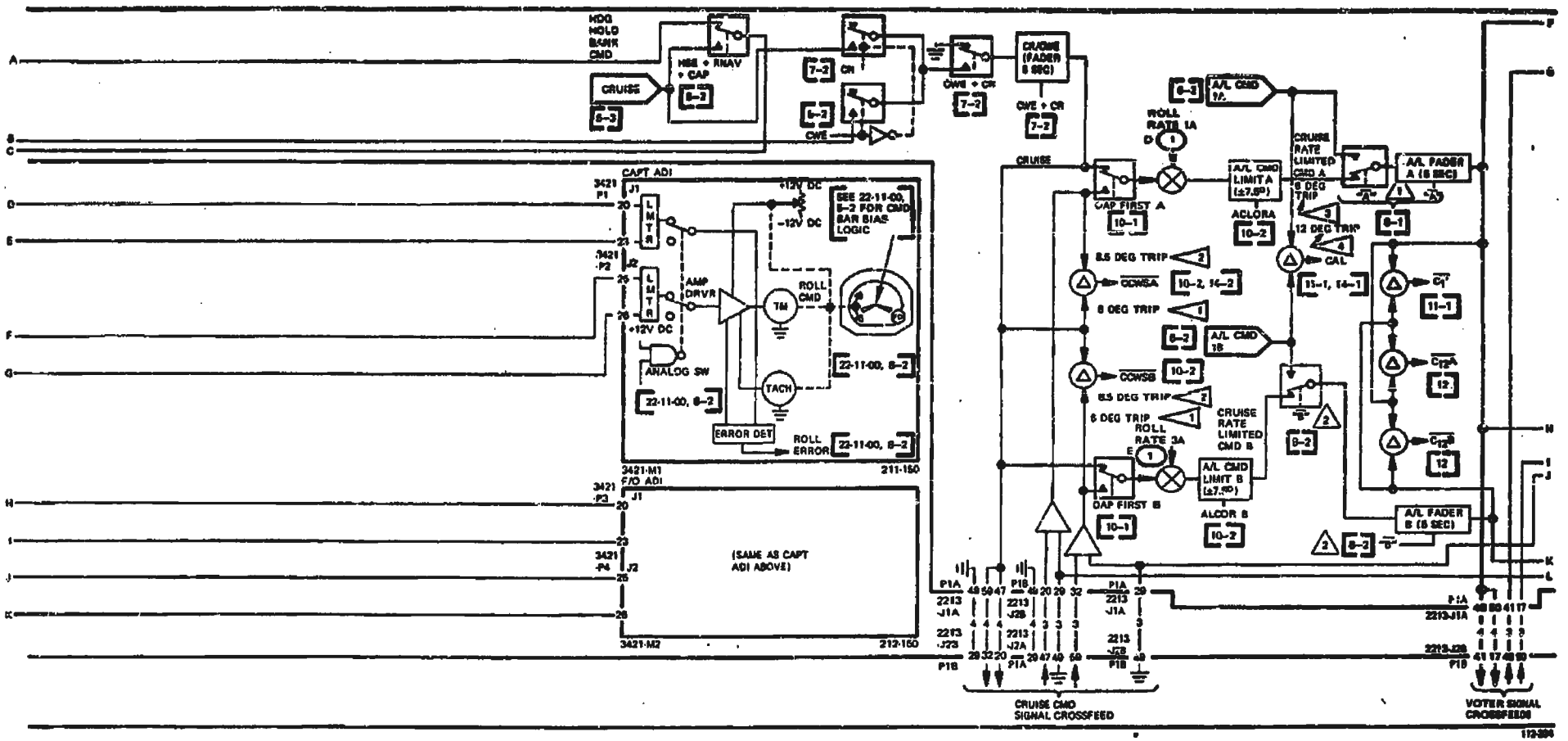
	A/L ENGAGE	LOC CAP	GS CAP	1500 FT RADIO ALT/ A/L TRACK	150 FT RADIO ALT/ ALIGN	50 FT RADIO ALT/ FLARE	5 FT RADIO ALT/ ROLLOUT GUIDANCE	TOUCHDOWN/ AGSS
	DUAL A/L NOT AVAIL	LOC GS ARM A/L ARM	LOC GS A/L ARM	LOC GS A/L ALN ARM FLR ARM	LOC GS A/L ALIGN FLR ARM	LOC GS A/L ALIGN FLARE	LOC GS A/L ALIGN FLARE ROLLOUT	DUAL A/L NOT AVAIL
	• A/L pressed. • A/L light comes on. • LOC ARM, GS ARM, A/L ARM modes are annunciated. • Second AP on.	• LOC mode is annunciated. • Airplane tracks LOC beam. • Pilots action.	• GS mode is annunciated. • Airplane NOSES OVER TO TRACK GS beam. • Approach gates appear.	• A/L TRACK mode is annunciated. • RUNWAY alignment is automatically armed. • Flare function is automatically armed. • Rudder goes into parallel operation. • Pitch trim bias is activated.	• ALIGN mode is annunciated. • Airplane aligns with RUNWAY and sets up CROSS-WIND CORRECTIONS. (The align command is a fwd slip command).	• FLARE mode is annunciated and flare is initiated. • Throttle levers move aft to FLIGHT IDLE at a rate of one knot per second.	• ROLLOUT mode is annunciated. • ROLLOUT guidance is in effect through rudder. • CMD bars disappear in both ADI. • YAW steering pointers appear in both ADI. • Approach gates disappear. • Speed approx. $1.2V_S$. • Throttle levers move aft to IDLE and STOP, and ATS disconnect automatically without ATS DISC message.	• Automatic ground spoilers deploy. • Autopilot lowers nosewheel smoothly (at a programmed rate) to RUNWAY. • Autopilot ROLLOUT guidance (controlling rudder and nosewheel) guides airplane along localizer beam center until disconnect.

- ILS FREQ SET
- AP A(B) CMD
- BOTH FD ON
- COURSE SET
- ATS BAT HANDLE ON


*Pilots Action
• Runway HDG on BUG.
• Gear down @ 2 dots GS deviation.
• Landing flaps > 30 deg.
ALPHA flag.
Speed controlled to 1.3Vs plus gust compensation and coupled go-around is armed
DLC becomes active.
AFCS WARNINGS
DUAL A/L NOT AVAIL
NO ALIGN
NO DUAL
NO GA
NO FLARE
ATS DISC
SPEED
AUTO FLIGHT CHANNEL
PITCH
ROLL
YAW
PITCH TRIM DLC/AGS
ADI
YAW STEERING PTR
APPROACH GATE
COMMAND BARS
DANA ACTIVE WHEN AP A(B) SET TO CWS OR CMD
DANA INHIBITED (STORED FOR RECALL)
DANA RECALL
NOT ACTIVE
ACTIVE (NON-LATCHING)
ACTIVE (LATCHED-IN)
ACTIVE
NOT ACTIVE
ACTIVE
ACTIVE 2
AIRSPEED MODE
ALPHA MODE (FLAPS POS > 30°)
THROT TO FLT IDLE
THROT TO IDLE & ATS DISC
PITCH RATE LIMIT ± 1.4° /S
PITCH RATE LIMIT ± 5° /S @ FLAPS > 30° OR A/L TRK
PITCH RATE LIMITS +5, - 1.4°/SEC
NOSE DN BIAS (1.2°/SEC)
21 LB PITCH FORCE TO OVERRIDE AP
HIGH PITCH HOOK AUTHORITY (44 LB PITCH FORCE TO OVERRIDE AP)
35 DEG ROLL LIMIT
10 DEG ROLL LIMIT
5 DEG ROLL LIMIT
0 DEG ROLL LIMIT
TC (TURN COORDINATION) FLAPS CHG GAIN
NO TC AFTER LOC TRK
TC WITH LOW GAIN
NO TC, FWD SLIP ALIGN CMD
PROCESSED ROLLOUT AND YAW RATE GUIDANCE
RUDDER PEDAL IN PARALLEL OPERATION
NOSE WHL STEERING
AUTO TRIM
NOSE DN BIAS & AUTO TRIM
NOSE UP BIAS AND AUTO TRIM
MAN. TRIM
NOT ACTIVE
DLC ACTIVE (FLAP HANDLE POSITION > 30°)
AGS ACTIVE
NOT-IN-VIEW
IN-VIEW
GOES-OUT-OF-VIEW
NOTE
1 Occurs at TOUCHDOWN when speed computer is not modified by Collins SB 23.
2 Not active when both roll computers are modified by Collins SB 38.
M1-0001-22-945

R AUTOLAND Fault Matrix
R Figure 103 (Sheet 11)

R EFFECTIVITY: ALL
R
001B

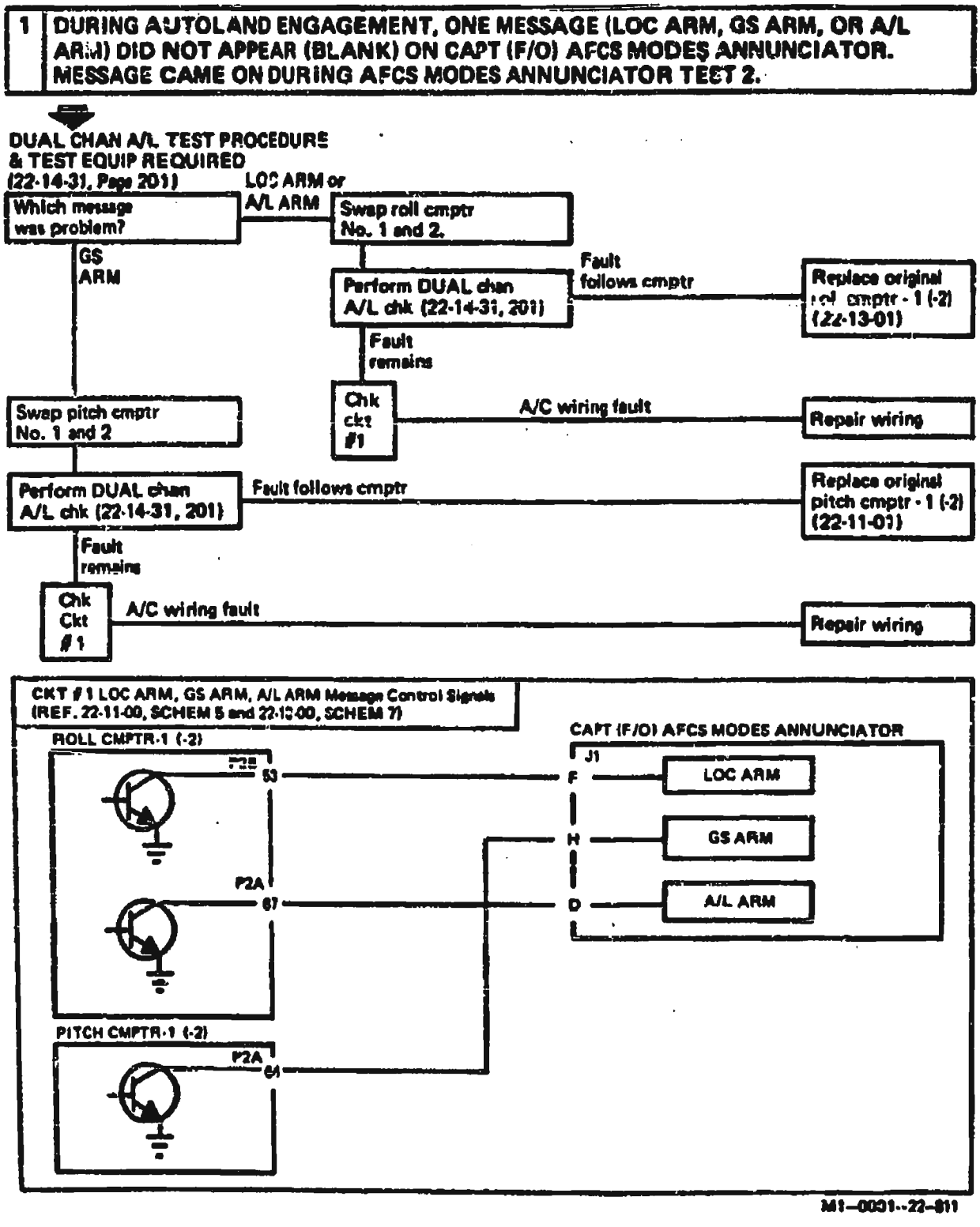


EM1-0000-22-4481

R Roll Systems No. 1 and No. 2 Basic Mode Signal Flow Schematic
R SCHEM 4 (Sheet 4)

EFFECTIVITY: ALL

0018


1 DURING AUTOLAND ENGAGEMENT, ONE MESSAGE (LOC ARM, GS ARM, OR A/L ARM) DID NOT APPEAR (BLANK) ON CAPT (F/O) AFCS MODES ANNUNCIATOR. MESSAGE CAME ON DURING AFCS MODES ANNUNCIATOR TEST 2.
DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, Page 201)
Which message was problem?
LOC ARM or A/L ARM
Swap roll cmptr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original roll cmptr - 1 (-2) (22-13-01)
Fault remains
Chk ckt #1
A/C wiring fault
Repair wiring
GS ARM
Swap pitch cmptr No. 1 and 2
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original pitch cmptr - 1 (-2) (22-11-01)
Fault remains
Chk Ckt #1
A/C wiring fault
Repair wiring
CKT #1 LOC ARM, GS ARM, A/L ARM Message Control Signals (REF. 22-11-00, SCHEM 5 and 22-13-00, SCHEM 7)
ROLL CMPTR-1 (-2)
P2B
53
P2A
67
PITCH CMPTR-1 (-2)
P2A
64
CAPT (F/O) AFCS MODES ANNUNCIATOR
J1
F
H
D
LOC ARM
GS ARM
A/L ARM
M1-0031--22-811

R A/L Mode Engagement Faults
R Figure 104 (Sheet 1)

R EFFECTIVITY: ALL

R
001B

2 DURING AUTOLAND ENGAGEMENT, ONLY GS ARM MESSAGE WAS DISPLAYED ON CAPT (F/O) AFCS MODES ANNUNCIATOR. OTHER ANNUNCIATOR DISPLAY WAS NORMAL (LOC ARM, GS ARM, A/L ARM). MESSAGES CAME ON DURING AFCS MODES ANNUNCIATOR TEST 2.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, Page 201)

Swap roll cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original roll cmptr-1 (-2) (22-13-01)

Fault remains

Swap pitch cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows comptr → Replace original pitch cmptr-1 (-2) (22-11-01)

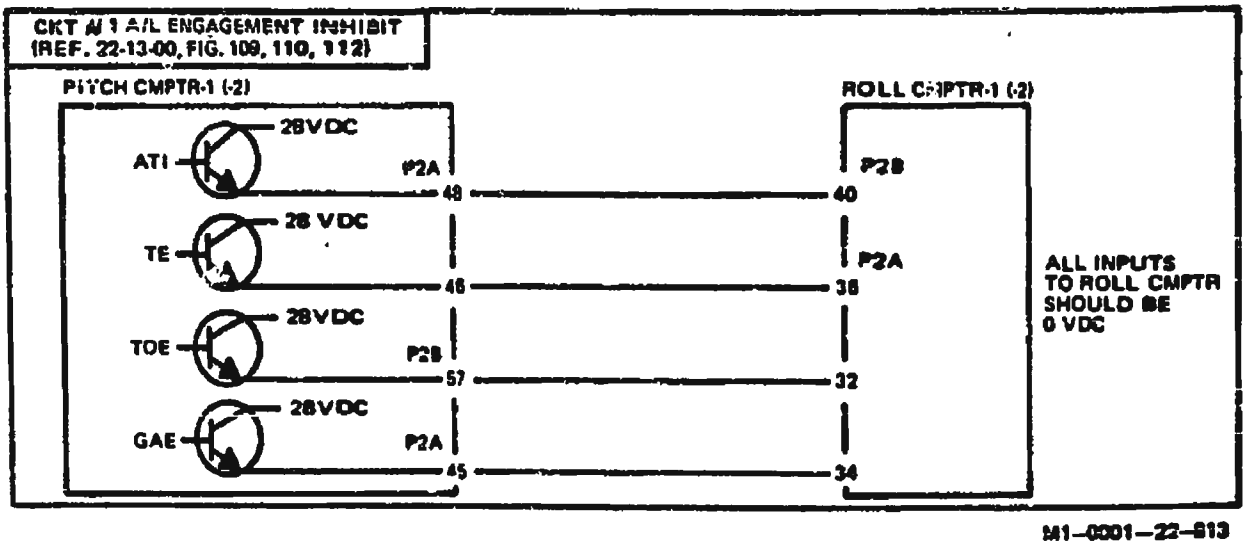
Fault remains

Chk ckt #1 (1)

A/C wiring fault → Repair wiring

NOTE

(1) Check for a hot short in the ATI, TE, TOE, or GAE input circuit to one of the two roll cmptr.



M1-0001-22-813

R A/L Mode Engagement Faults
R Figure 104 (Sheet 2)

R EFFECTIVITY: ALL

R

001B

3	DURING AUTOLAND ENGAGEMENT, LOC MESSAGE IS DISPLAYED AS SOON AS A/L SWITCHLIGHT IS DEPRESSED. AP COMMANDS A MANEUVER TO CENTER ON LOC BEAM (AS SHOWN ON HSI) WHEN AP A (B) WAS ENGAGED FIRST. /1\
4	DURING AUTOLAND ENGAGEMENT, LOC MESSAGE IS DISPLAYED AS SOON AS A/L SWITCHLIGHT IS DEPRESSED. AP DOES NOT COMMAND A MANEUVER TO CENTER ON LOC BEAM (AS SHOWN ON HSI). AP A (B) WAS ENGAGED FIRST.

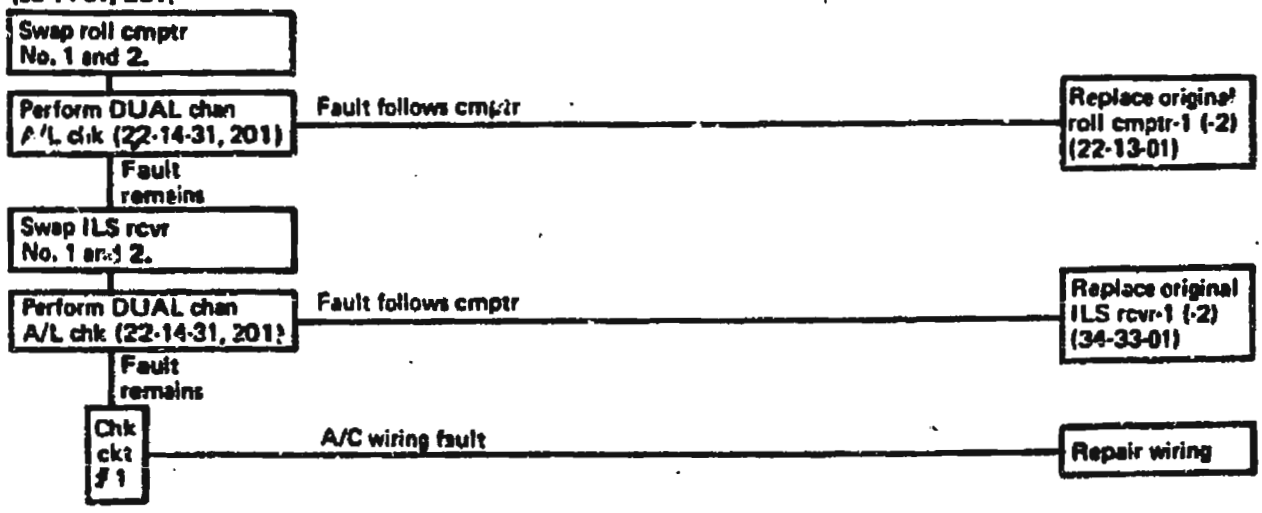
"SAME FAULT BUT DIFFERENT SYMPTOMS DUE TO AP ENGAGED FIRST"

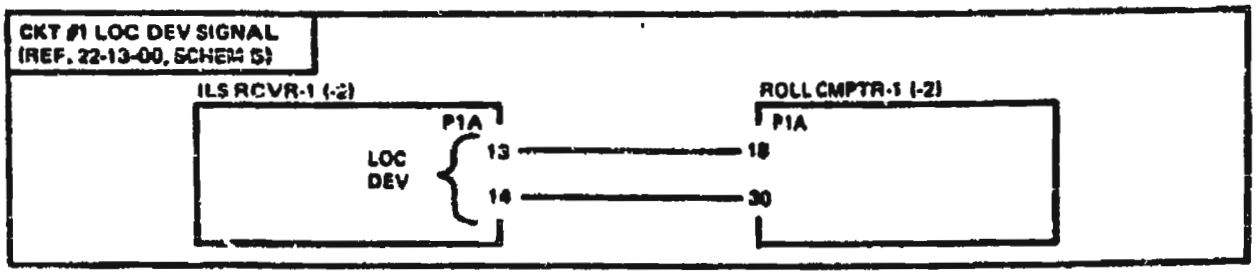
AT AUTOLAND ENGAGEMENT, LOC CAPTURE IS DISPLAYED. AP COMMANDS A MANEUVER TO CENTER ON LOC BEAM WHEN AP A (B) WAS ENGAGED FIRST. /1\ WHEN OTHER AP IS ENGAGED FIRST, AP DOES NOT COMMAND A MANEUVER TO CENTER ON LOC BEAM.

NOTE

/1\ Fault 3 will not occur when roll cmptr modified by Collins SB 38 are used.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)


Swap roll cmptr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original roll cmptr-1 (-2) (22-13-01)
Fault remains
Swap ILS rcvr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original ILS rcvr-1 (-2) (34-33-01)
Fault remains
Chk ckt #1
A/C wiring fault
Repair wiring



M1-0001-22-815

R A/L Mode Engagement Faults
R Figure 104 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

5	DURING AUTOLAND ENGAGEMENT, A FD FLAG COMES INTO VIEW ON CAPT (F/O) ADI AS SOON AS A/L SWITCHLIGHT IS DEPRESSED. AP BAT HANDLE (SAME SIDE) DROPS TO CWS IF ENGAGED FIRST. IF BAT HANDLE (SAME SIDE) IS ENGAGED SECOND, IT DROPS TO OFF WHEN RELEASED. RADIO ALT FLAG IN-VIEW ON RADIO ALT INDICATOR (SAME SIDE). /1\ DANA LIGHT COMES ON IMMEDIATELY AFTER AP BAT HANDLE IS SET TO CWS FROM OFF.

(Reference Ckt-Radio Alt-RT P1B-12 to Pitch Cmptr P1A-12) → Replace Radio Alt RT-1 (-2) (34-32-01)

NOTE

/1\ DANA light does not come on when pitch cmptrs modified by Collins SB 37 are used

6	DURING AUTOLAND ENGAGEMENT, A FD FLAG COMES INTO VIEW ON CAPT (F/O) ADI AS SOON AS A/L SWITCHLIGHT IS DEPRESSED. AP BAT HANDLE (SAME SIDE) DROPS TO CWS IF ENGAGED FIRST. IF AP BAT HANDLE (SAME SIDE) IS ENGAGED SECOND, IT DROPS TO OFF WHEN RELEASED. NO OTHER COCKPIT INDICATIONS.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Swap pitch cmptr No. 1 and 2.

Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

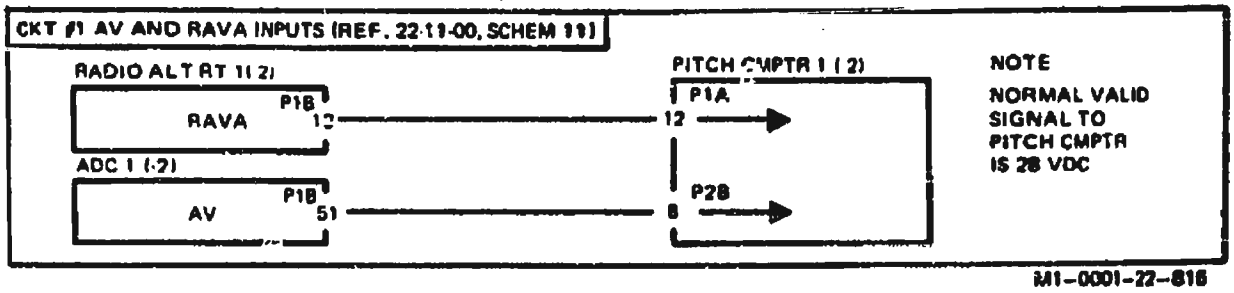
Perform DUAL chan A/L chk (22-14-31, 201)

Fault remains

- With both FD on, engage ALT HOLD mode.
- Did FD flag come into view on ADI (same side).

Yes → Chk ckt #1 "AV"
- Ckt chk OK → Replace ADC-1 (-2) (34-14-01)
- A/C wiring fault → Repair wiring

No → Chk ckt #1 "RAVA"
- Ckt chk OK → Replace Radio Alt RT-1 (-2) (34-32-01)
- A/C wiring fault → Repair wiring



M1-0001-22-816

A/L Mode Engagement Faults
Figure 104 (Sheet 4)

EFFECTIVITY: ALL

001B

7	DURING AUTOLAND ENGAGEMENT, AP A(B) BAT HANDLE DROPS TO CWS. FD FLAG COMES INTO VIEW ON ADI (SAME SIDE). [BOTH VHF NAV CONTROL PANELS ARE TUNED TO ILS FREQUENCY.] WHEN OTHER BAT HANDLE IS ENGAGED FIRST, AUTOLAND ENGAGEMENT IS NORMAL.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Swap roll cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original roll comptr-1 (-2) (22-13-01)

Fault remains

Swap Capt and F/O VHF NAV cont pnl.

Perform DUAL chan A/L chk (22-14-31, 201)

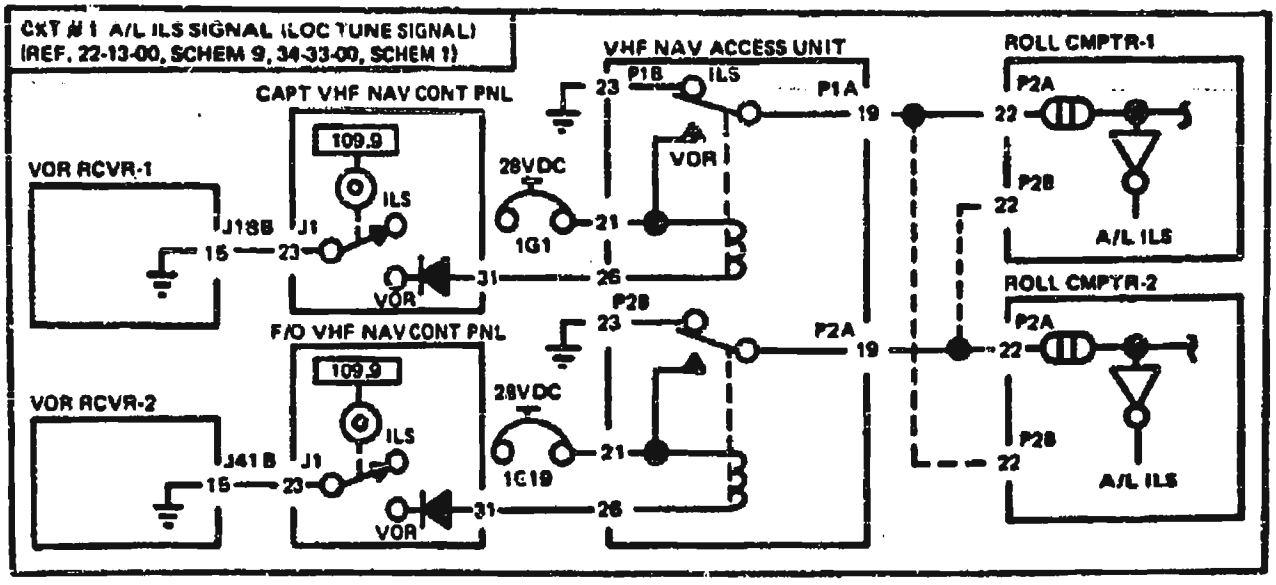
Fault follows cont pnl → Replace original VHF NAV cont pnl (34-55-02).

Fault remains

Chk ckt #1

Accessory unit has internal hot short → Replace VHF NAV accessory unit (34-55-06)

A/C wiring has hot short → Repair wiring



M1-0001-22-818

R A/L Mode Engagement Faults
R Figure 104 (Sheet 5)

R EFFECTIVITY: ALL

R
R
001B

8	DURING AUTOLAND ENGAGEMENT, A/L LIGHT DID NOT COME ON. ALL OTHER COCKPIT INDICATIONS NORMAL.

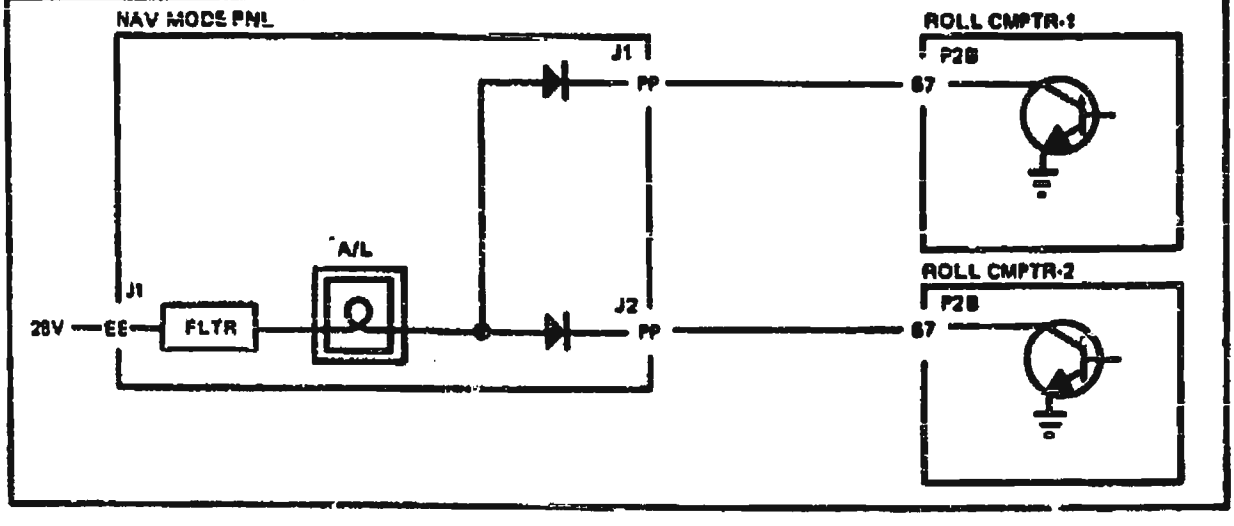
A/L light ckt shorted in NAV MODE panel causing transistors in both roll cmptr to burn out.

Determine if short is in light assy or NAV MODE pnl (Ref. ckt # 1).

Replace light assy (20-33-01) NAV MODE pnl (22-10-C2) as required.

When short is cleared, replace both roll cmptr (22-13-01)

CKT # 1 A/L LIGHT CONTROL CKT (REF. 22-13-00, SCHEM 7)



M1-0002-22-820

R A/L Mode Engagement Faults
R Figure 104 (Sheet 6)

R EFFECTIVITY: ALL
R
001B

11 DURING AUTOLAND (AT LEAST 30 SEC AFTER LOC CAPTURE BUT PRIOR TO A/L MESSAGE), NO ALIGN MESSAGE IS DISPLAYED. AFTER A/L MESSAGE, ALIGN ARM, ALIGN AND ROLLOUT MESSAGES WERE NOT DISPLAYED ON AFCS MODES ANNUNCIATOR. ADI YAW STEERING POINTERS DO NOT COME IN-VIEW AT ROLLOUT.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Substitute for both yaw cmptr with one's known to be good.

Perform DUAL chan A/L chk (22-14-31, 201)

Fault Cleared → Determine which Yaw Cmptr is faulty and replace it. (22-15-01)

Fault Remains

- Remove Yaw Cmptr-1, and -2.
- Are analog inputs to each Yaw Cmptr the same? (See ckt # 1)

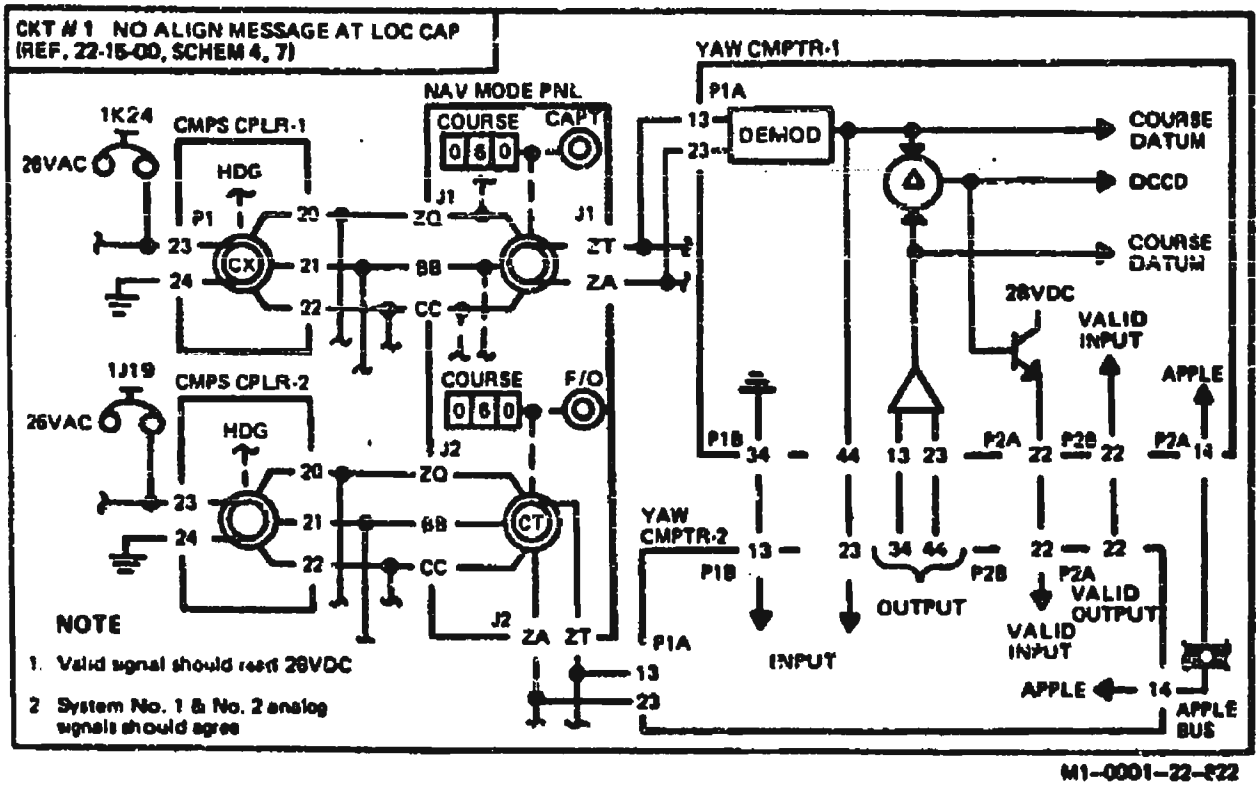
No → Chk analog input ckt # 1

- NAV mode pnl has internal open/short ckt → Replace NAV MODE pnl (22-10-02)
- Cmp cplr has internal open/short ckt → Replace Cmps Cplr-1 (-2) (34-22-03)
- A/C wiring fault → Repair wiring

Yes

- Ckt wiring between Yaw Cmptr (See ckt # 1)

A/C wiring fault → Repair wiring

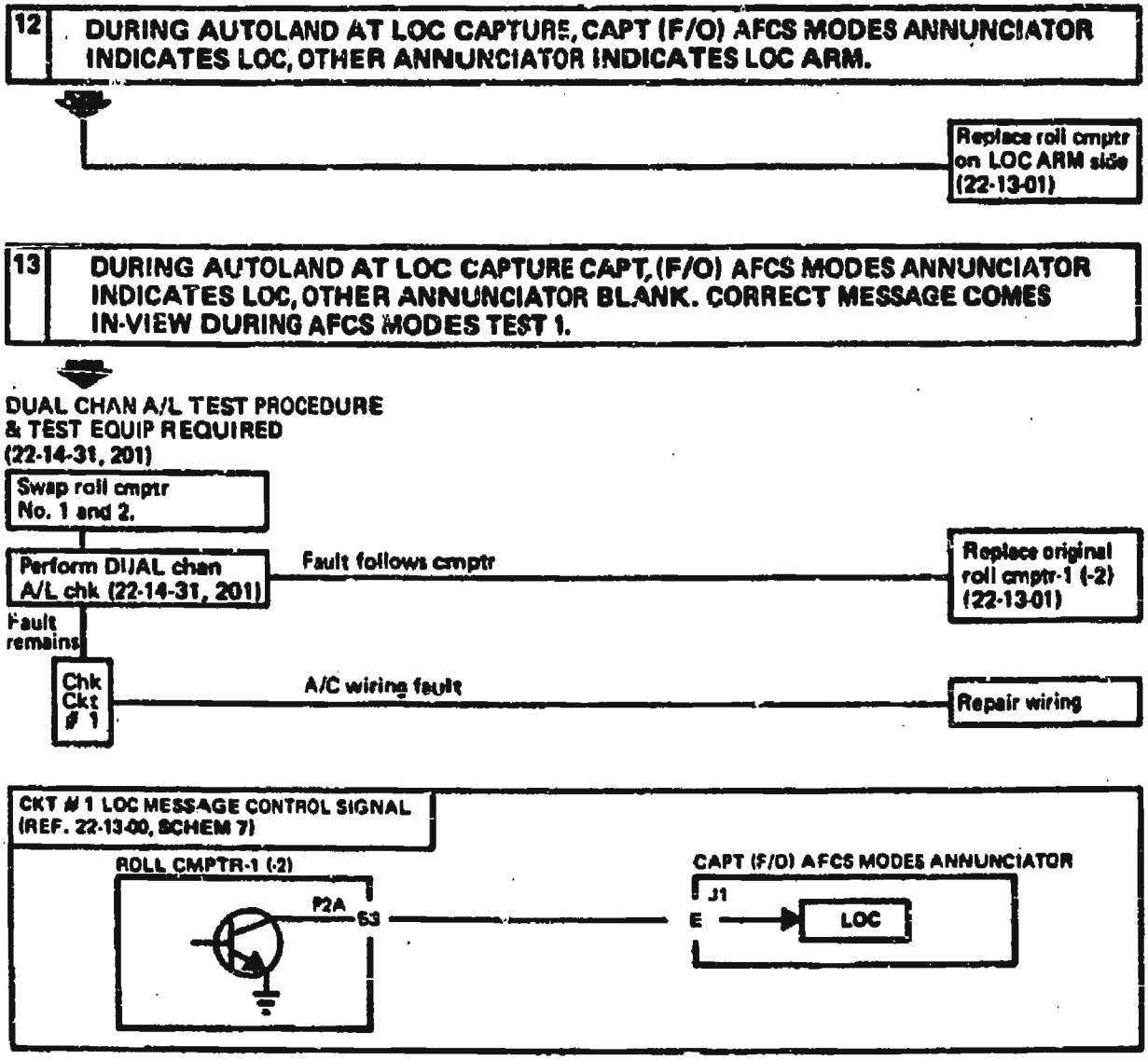


M1-0001-22-022

R A/L LOC Capture Mode Faults
R Figure 105 (Sheet 1)

R EFFECTIVITY: ALL

001B


12
DURING AUTOLAND AT LOC CAPTURE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES LOC, OTHER ANNUNCIATOR INDICATES LOC ARM.
Replace roll cmptr on LOC ARM side (22-13-01)
13
DURING AUTOLAND AT LOC CAPTURE CAPT, (F/O) AFCS MODES ANNUNCIATOR INDICATES LOC, OTHER ANNUNCIATOR BLANK. CORRECT MESSAGE COMES IN-VIEW DURING AFCS MODES TEST 1.
DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)
Swap roll cmptr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original roll cmptr-1 (-2) (22-13-01)
Fault remains
Chk Ckt # 1
A/C wiring fault
Repair wiring
CKT # 1 LOC MESSAGE CONTROL SIGNAL (REF. 22-13-00, SCHEM 7)
ROLL CMPTR-1 (-2)
P2A
53
CAPT (F/O) AFCS MODES ANNUNCIATOR
J1
E
LOC

M1-0001-22-826

R A/L LOC Capture Mode Faults
R Figure 105 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

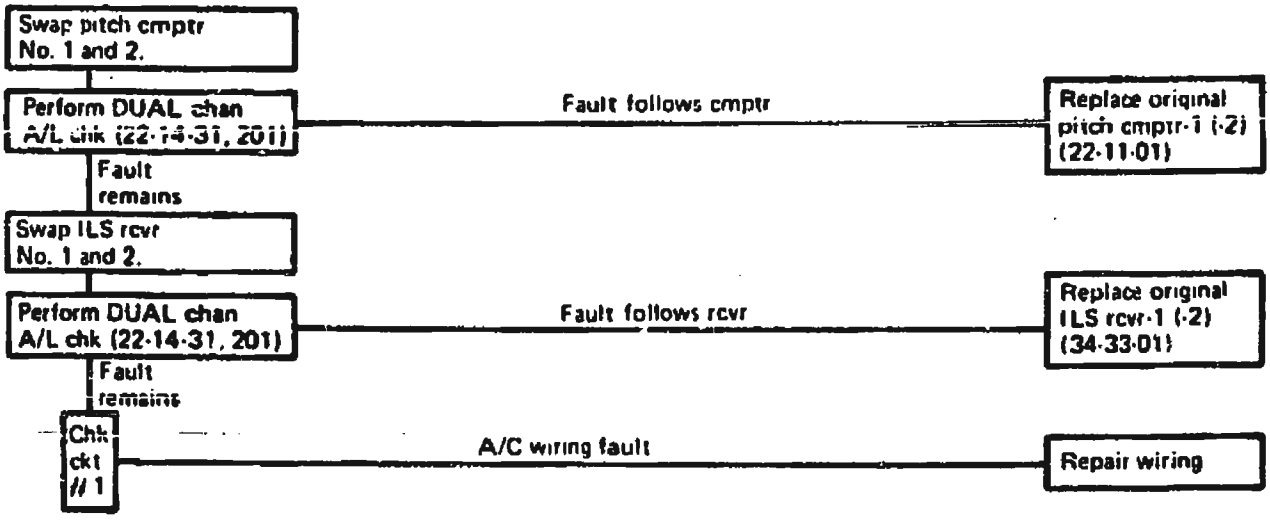
14	DURING AUTOLAND AT LOC CAPTURE, GS MESSAGE IS DISPLAYED IMMEDIATELY. AP COMMANDS A MANEUVER TO CENTER ON GS BEAM (AS SHOWN ON HSI), WHEN AP A (B) WAS ENGAGED FIRST. ⚠1
15	DURING AUTOLAND AT LOC CAPTURE, GS MESSAGE IS DISPLAYED IMMEDIATELY. AP DOES NOT COMMAND A MANEUVER TO CENTER ON GS BEAM (AS SHOWN ON HSI).

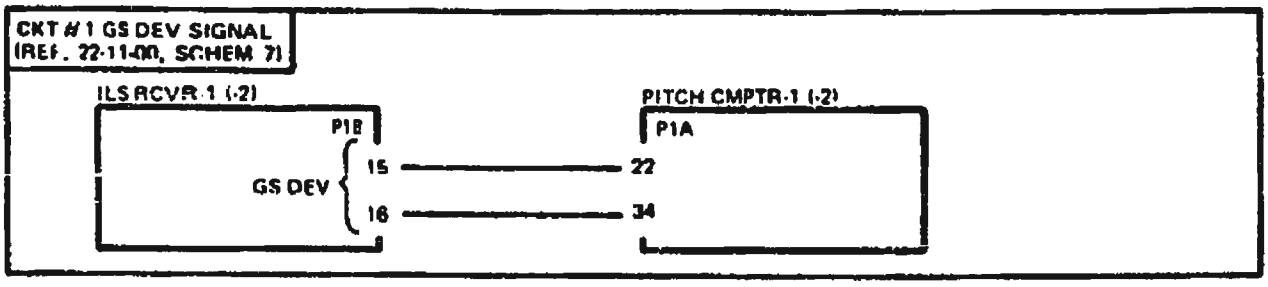
"SAME FAULT BUT DIFFERENT SYMPTOMS DUE TO AP ENGAGED FIRST"

AT LOC CAPTURE, GS CAPTURE IS DISPLAYED. AP COMMANDS A MANEUVER TO CENTER ON GS BEAM WHEN AP A (B) WAS ENGAGED FIRST ⚠1 . WHEN OTHER AP IS ENGAGED FIRST, AP DOES NOT COMMAND A MANEUVER TO CENTER ON GS BEAM.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

⚠1 NOTE
Fault 14 will not occur when pitch cmptr with Collins SB 37 are used.


Swap pitch cmptr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original pitch cmptr-1 (-2) (22-11-01)
Fault remains
Swap ILS rcvr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows rcvr
Replace original ILS rcvr-1 (-2) (34-33-01)
Fault remains
Chk ckt # 1
A/C wiring fault
Repair wiring



M1-0001-22-833

A/L LOC Capture Mode Faults
Figure 105 (Sheet 3)

EFFECTIVITY: ALL

16	DURING AUTOLAND AFTER LOC CAPTURE, AP A (B) BAT HANDLE DROPS TO OFF AND ADI (SAME SIDE) HAS FD FLAG IN-VIEW. NO DUAL MESSAGE AT A/L CAPTURE. – – 1 DANA LIGHT CAME ON IMMEDIATELY AFTER BAT HANDLE WAS SET TO CWS, FROM OFF WITH VOR FREQ SELECTED. WHEN ILS FREQ WAS SELECTED SELECTED LOC FLAGS APPEARED ON HSI (SAME SIDE).

RC P18-57 & P1A-61

Replace ILS rcvr-1 (-2) (34-33-01)

NOTE

1 DANA light does not come on when roll cmptr with Collins SB 38 are used.

MI-0100-22-837

R A/L LOC Capture Mode Faults
R Figure 105 (Sheet 4)

EFFECTIVITY: ALL

0018

17	DURING AUTOLAND AFTER LOC CAPTURE, AP A (B) BAT HANDLE DROPS TO OFF AND ADI (SAME SIDE) HAS FD FLAG IN VIEW. NO DUAL MESSAGE AT A/L CAPTURE. -- ⚠1 DANA LIGHT CAME ON IMMEDIATELY AFTER AP BAT HANDLE WAS SET TO CWS, FROM OFF WITH VOR FREQ SELECTED.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

⚠1 NOTE
DANA light does not come on when roll cmptr with Collins SB 38 are used.

Swap roll cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows cmptr → Replace original roll cmptr-1 (-2) (22-13-01)

Fault remains

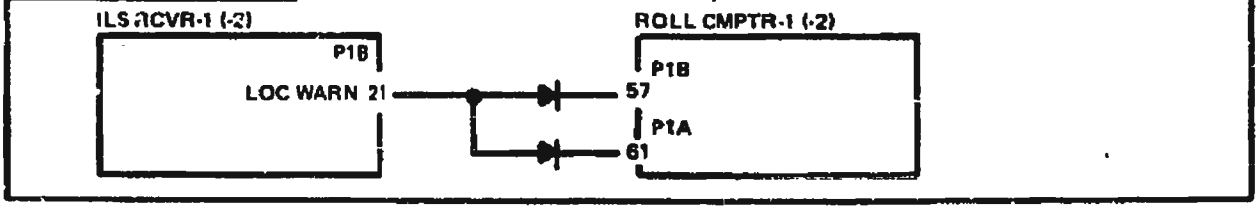
Swap ILS rcvr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows rcvr → Replace original ILS rcvr-1 (-2) (34-33-01)

Fault remains

Chk ckt # 1 — A/C wiring fault → Repair wiring

CKT # 1 LOC WARN SIG (REF. 22-13-00, SCHEM 9)



M1-0001-22-010

R A/L LOC Capture Mode Faults
R Figure 105 (Sheet 5)

EFFECTIVITY: ALL

001B

21 DURING AUTOLAND AT GS CAPTURE, NO GA MESSAGE COMES INTO VIEW ON AFCS WARNING INDICATORS. NO OTHER COCKPIT INDICATIONS

→ Replace speed cont cmptr (22-31-07)

NOTE

When speed control system faults (ATS FAIL light(s), etc.) are observed along with NO GA message, go to 22-31-00 fault isolation

22 DURING AUTOLAND AT GS CAPTURE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES GS, OTHER ANNUNCIATOR INDICATES GS ARM

→ Replace pitch cmptr-1 (-2) (22-11-01)

23 DURING AUTOLAND AT GS CAPTURE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES GS, OTHER ANNUNCIATOR BLANK. MESSAGE COMES IN-VIEW DURING AFCS MODES TEST 1

→ DUAL CHAN A/L PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Swap pitch cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

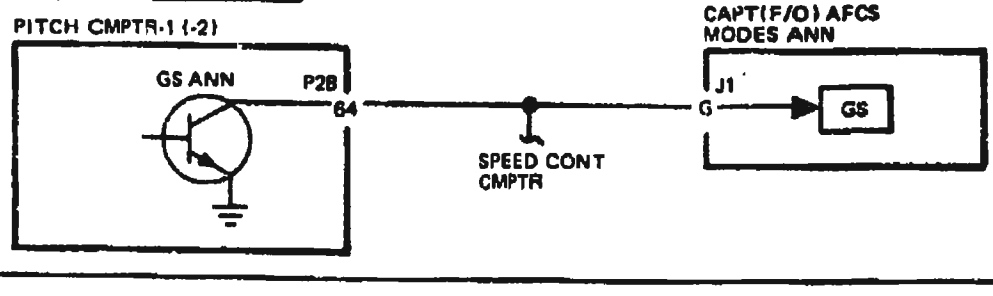
Fault follows cmptr → Replace original pitch cmptr -1 (-2) (22-11-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring

CKT #1 GS CAPTURE ANN SIGNAL (REF. 22-11-00, SCHEM 15)



M1-0001-22-849

R R A/L GS Capture Mode Faults
Figure 106 (Sheet 1)

R R 001B EFFECTIVITY: ALL

24	DURING AUTOLAND AFTER GS CAPTURE, AP A (B) BAT HANDLE DROPS TO OFF AND ADI (SAME SIDE) HAS FD FLAG IN-VIEW. NO DUAL MESSAGE AT A/L CAPTURE. – – ⚠1 DANA LIGHT CAME ON IMMEDIATELY AFTER AP BAT HANDLE WAS SET TO CWS, FROM OFF WITH VOR FREQ SELECTED. WHEN ILS FREQ WAS SELECTED; GS FLAGS APPEARED ON HSI (SAME SIDE).

Replace ILS rcvr-1 (2) (34-33-01)

NOTE

⚠1 DANA light does not come on when roll cmptr with Collins SB-38 are used.

M1-0100-22-850

R
R A/L GS Capture Mode Faults
Figure 106 (Sheet 2)

R EFFECTIVITY: ALL
R
0018

25 DURING AUTOLAND AFTER GS CAPTURE, AP A(B) BAT HANDLE DROPS TO OFF AND ADI (SAME SIDE) HAS FD FLAG IN-VIEW.
⚠1 DANA LIGHT COMES ON AFTER GS CAPTURE. NO DUAL MESSAGE AT A/L CAPTURE

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

⚠1 NOTE
DANA light does not come on when pitch cmptr with Collins SB 37 are used

Swap pitch cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains

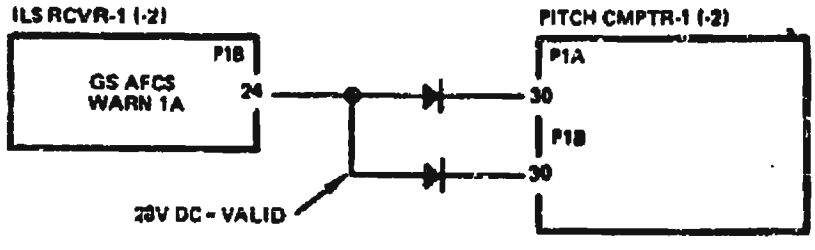
Swap ILS rcvr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows rcvr → Replace original ILS rcvr-1 (-2) (34-33-01)

Fault remains

Chk ckt #1 — A/C wiring fault → Repair wiring

CKT #1 GS VALID SIGNAL (REF. 22-11-00, SCHEM 15)



M1-0001-22-851

R R A/L GS Capture Mode Faults
Figure 106 (Sheet 3)

R R EFFECTIVITY: ALL

001B

28 DURING AUTOLAND AT GS CAPTURE, CAPT (F/O) ADI APPROACH GATE DID NOT COME IN-VIEW

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Swap pitch cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains

Swap Capt and F/O ADI.

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows ADI → Replace original ADI (34-21-07)

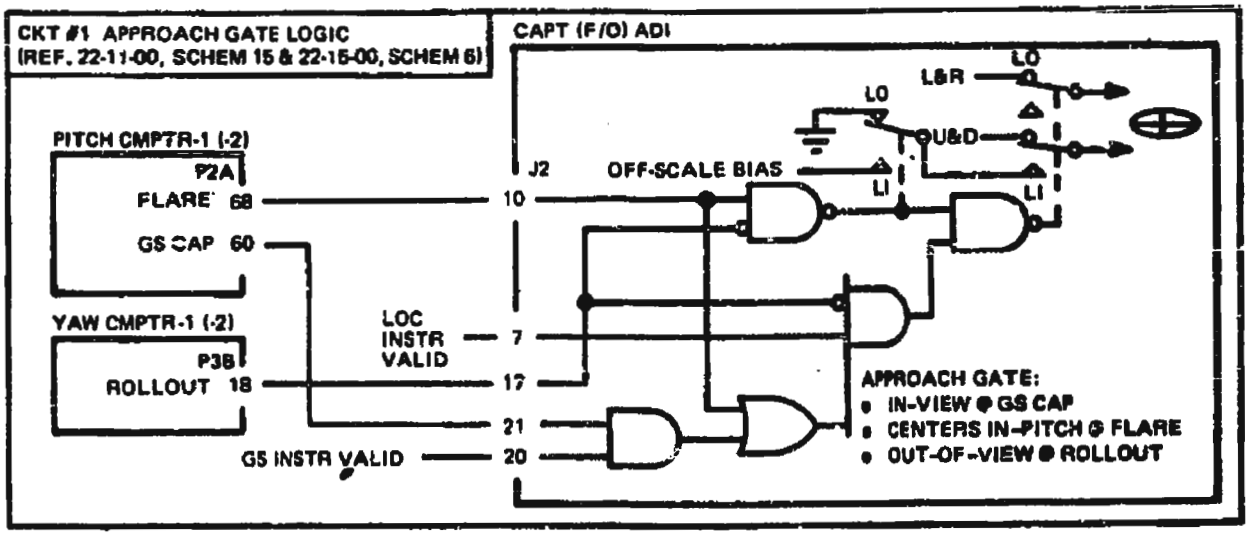
Fault remains

Swap yaw cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows cmptr → Replace original yaw cmptr -1 (-2)

Fault remains

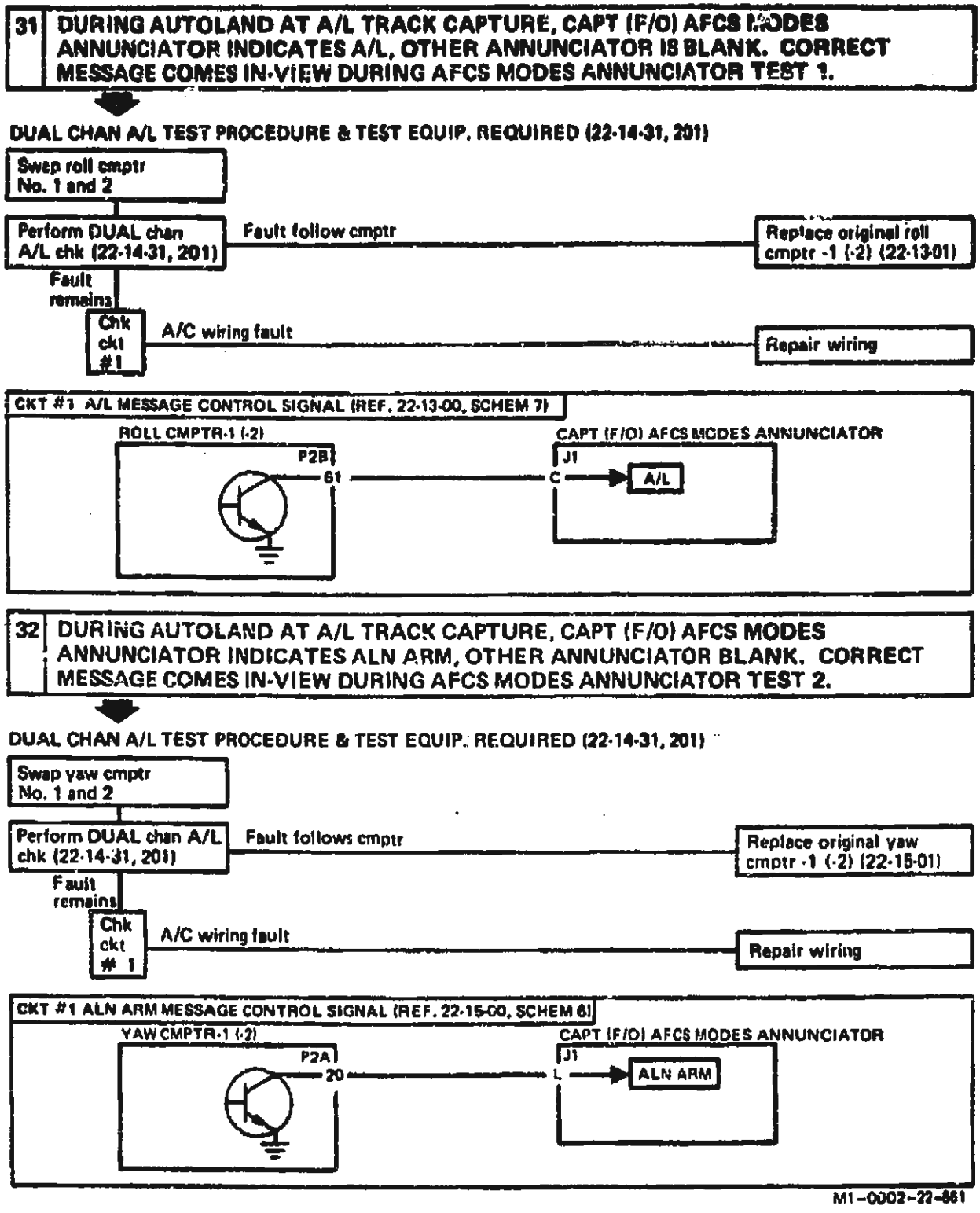
Chk ckt #1 — A/C wiring fault → Repair wiring



M1-0001-22-852

R A/L GS Capture Mode Faults
R Figure 106 (Sheet 4)

R EFFECTIVITY: ALL


31 DURING AUTOLAND AT A/L TRACK CAPTURE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES A/L, OTHER ANNUNCIATOR IS BLANK. CORRECT MESSAGE COMES IN-VIEW DURING AFCS MODES ANNUNCIATOR TEST 1.
DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP. REQUIRED (22-14-31, 201)
Swap roll cmptr No. 1 and 2
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follow cmptr
Replace original roll cmptr -1 (-2) (22-13-01)
Fault remains
Chk ckt #1
A/C wiring fault
Repair wiring
CKT #1 A/L MESSAGE CONTROL SIGNAL (REF. 22-13-00, SCHEM 7)
ROLL CMPTR-1 (-2)
P2B
61
CAPT (F/O) AFCS MODES ANNUNCIATOR
J1
C
A/L
32 DURING AUTOLAND AT A/L TRACK CAPTURE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES ALN ARM, OTHER ANNUNCIATOR BLANK. CORRECT MESSAGE COMES IN-VIEW DURING AFCS MODES ANNUNCIATOR TEST 2.
DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP. REQUIRED (22-14-31, 201)
Swap yaw cmptr No. 1 and 2
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original yaw cmptr -1 (-2) (22-15-01)
Fault remains
Chk ckt # 1
A/C wiring fault
Repair wiring
CKT #1 ALN ARM MESSAGE CONTROL SIGNAL (REF. 22-15-00, SCHEM 6)
YAW CMPTR-1 (-2)
P2A
20
CAPT (F/O) AFCS MODES ANNUNCIATOR
J1
L
ALN ARM
M1-0002-22-561

R A/L Track Mode Faults
R Figure 107 (Sheet 1)

EFFECTIVITY: ALL

001B

33 DURING AUTOLAND AT A/L TRACK CAPTURE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES FLR ARM, OTHER ANNUNCIATOR BLANK. CORRECT MESSAGE COMES IN VIEW DURING AFCS MODES TEST 2

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Swap pitch cmptr No. 1 and 2

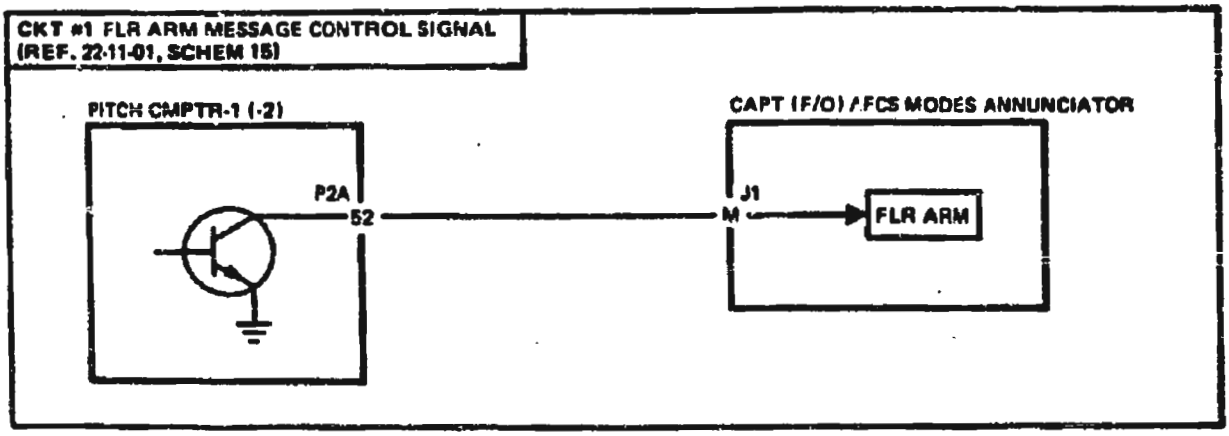
Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring



33A DURING AUTOLAND GROUND TEST AT A/L TRK, NO DUAL MESSAGE IS DISPLAYED AND LATCHED DANA IS DISPLAYED. NO OTHER COCKPIT INDICATIONS

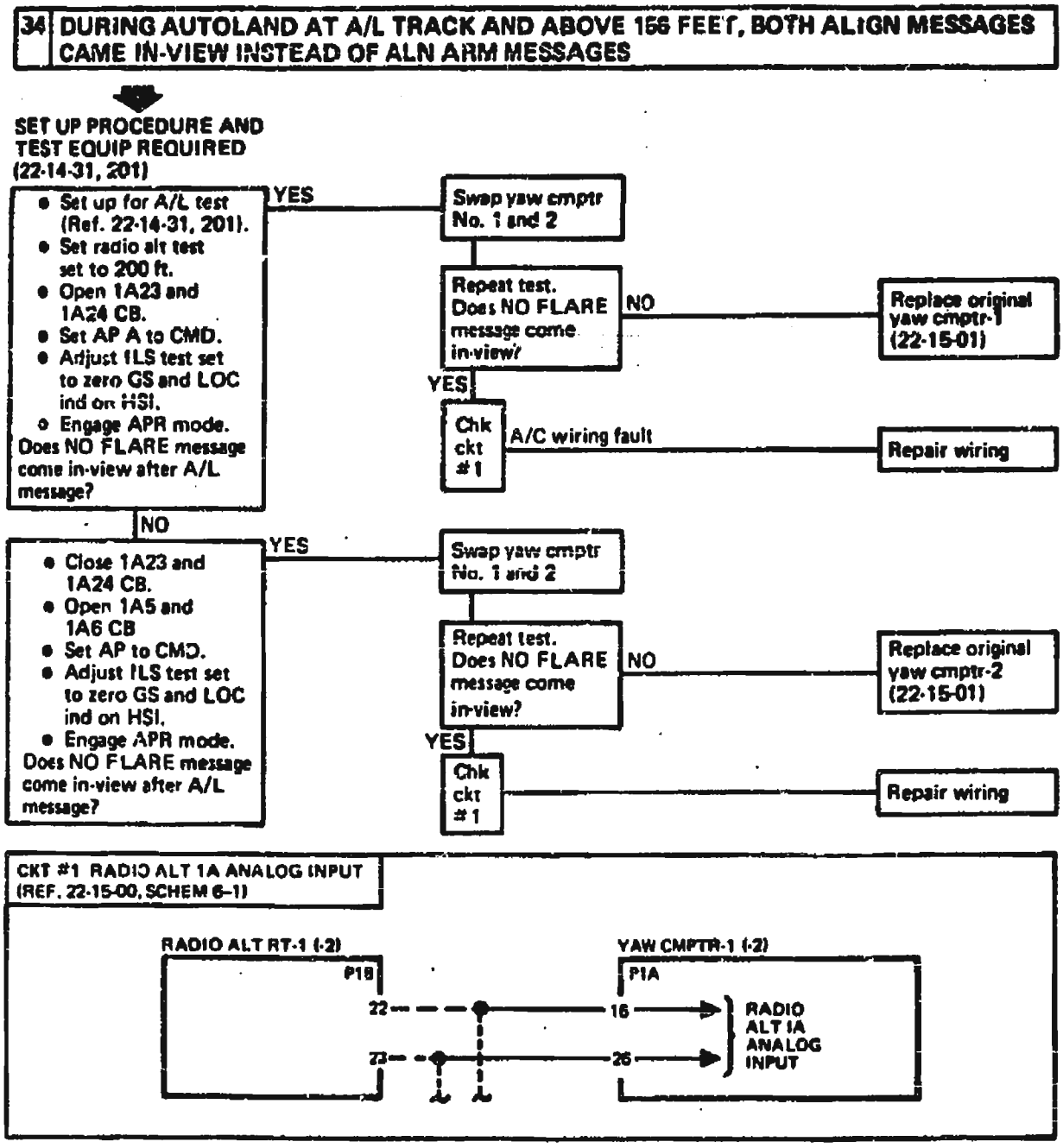
One AP servo high authority hook pressure switch output is not 28 VDC at A/L track → Go to 22-12-37, Fault 11

M1-0002-22-862

A/L Track Mode Faults
Figure 107 (Sheet 2)

EFFECTIVITY: ALL

001B


34 DURING AUTOLAND AT A/L TRACK AND ABOVE 156 FEET, BOTH ALIGN MESSAGES CAME IN-VIEW INSTEAD OF ALN ARM MESSAGES
SET UP PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)
• Set up for A/L test (Ref. 22-14-31, 201).
• Set radio alt test set to 200 ft.
• Open 1A23 and 1A24 CB.
• Set AP A to CMD.
• Adjust ILS test set to zero GS and LOC ind on HSI.
• Engage APR mode.
Does NO FLARE message come in-view after A/L message?
YES
Swap yaw cmptr No. 1 and 2
Repeat test. Does NO FLARE message come in-view?
NO
Replace original yaw cmptr-1 (22-15-01)
YES
Chk ckt #1
A/C wiring fault
Repair wiring
NO
• Close 1A23 and 1A24 CB.
• Open 1A5 and 1A6 CB
• Set AP to CMD.
• Adjust ILS test set to zero GS and LOC ind on HSI.
• Engage APR mode.
Does NO FLARE message come in-view after A/L message?
YES
Swap yaw cmptr No. 1 and 2
Repeat test. Does NO FLARE message come in-view?
NO
Replace original yaw cmptr-2 (22-15-01)
YES
Chk ckt #1
Repair wiring
CKT #1 RADIO ALT 1A ANALOG INPUT (REF. 22-15-00, SCHEM 6-1)
RADIO ALT RT-1 (-2)
P1B
22
23
YAW CMPTR-1 (-2)
P1A
16
26
RADIO ALT 1A ANALOG INPUT

M1-0001-22-003

R R A/L Track Mode Faults
Figure 107 (Sheet 3)

R R 001B EFFECTIVITY: ALL

35	DURING AUTOLAND AT A/L TRACK, NO DUAL MESSAGE IS DISPLAYED. YAW SAS 1 OR 2 FAIL LIGHT ON. FLT CONT PANELS ANNUNCIATOR CAME ON. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED.

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (Ref. 22-14-31, Fig. 103)

Swap yaw cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

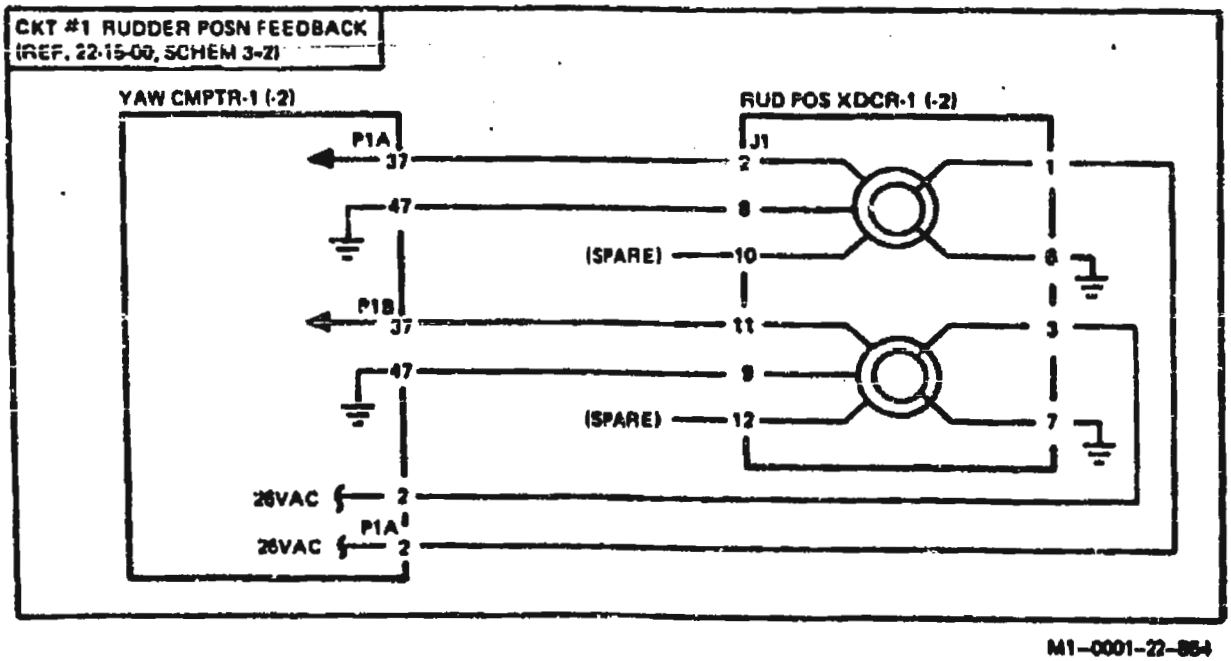
Fault follows cmptr → Replace original yaw cmptr -1 (2) (22-15-01)

Fault remains

Chk ckt #1

Rud posn xdcr has internal open/short ckt → Replace rudder posn XCR-1 (-2) (22-15-03)

Ckt chk OK → GO TO 22-15-00, Figure 103,
- Fault 1 (Yaw SAS-1 FAIL)
- Fault 4 (Yaw SAS-2 FAIL)

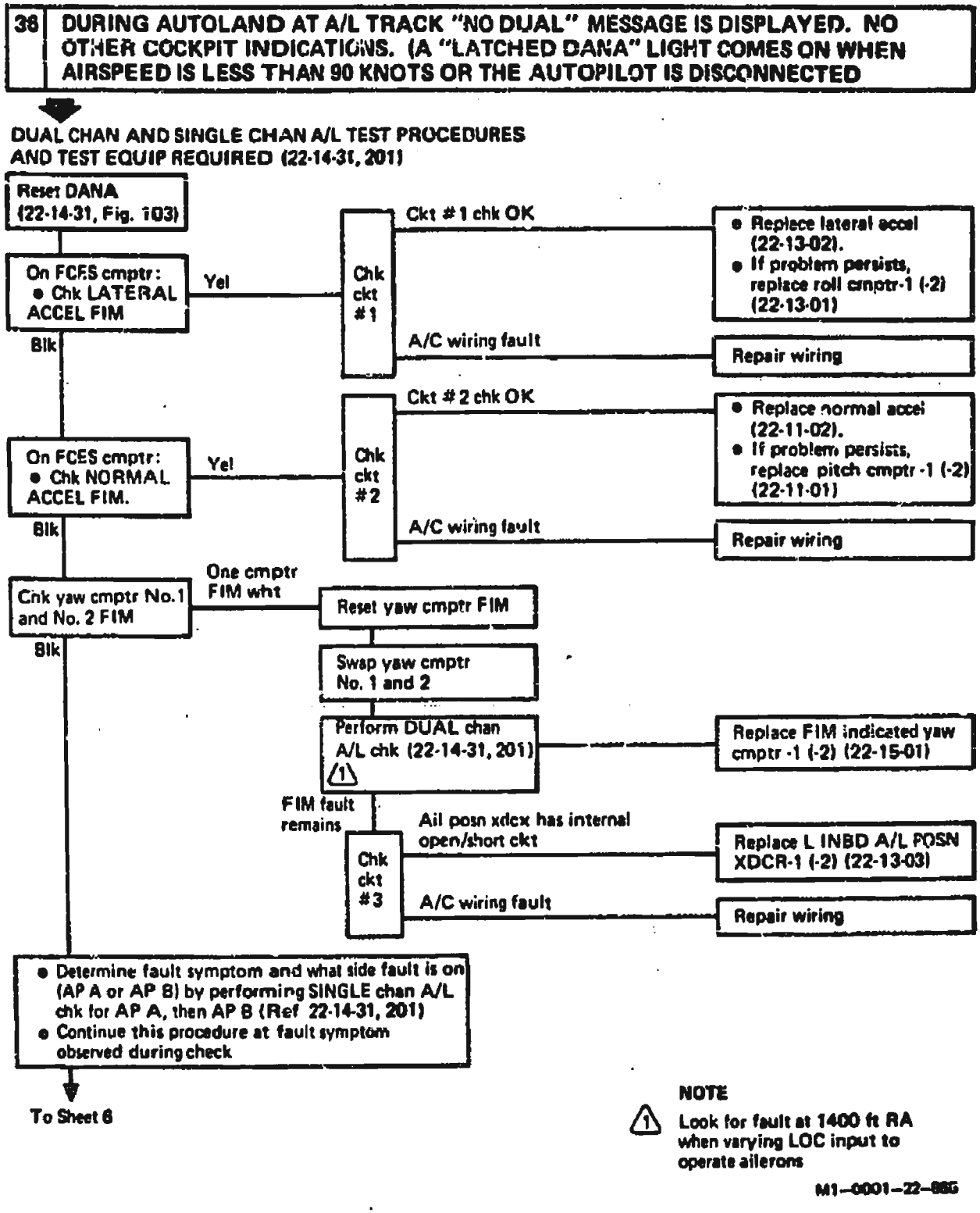


M1-0001-22-864

R R A/L Track Mode Faults
Figure 107 (Sheet 4)

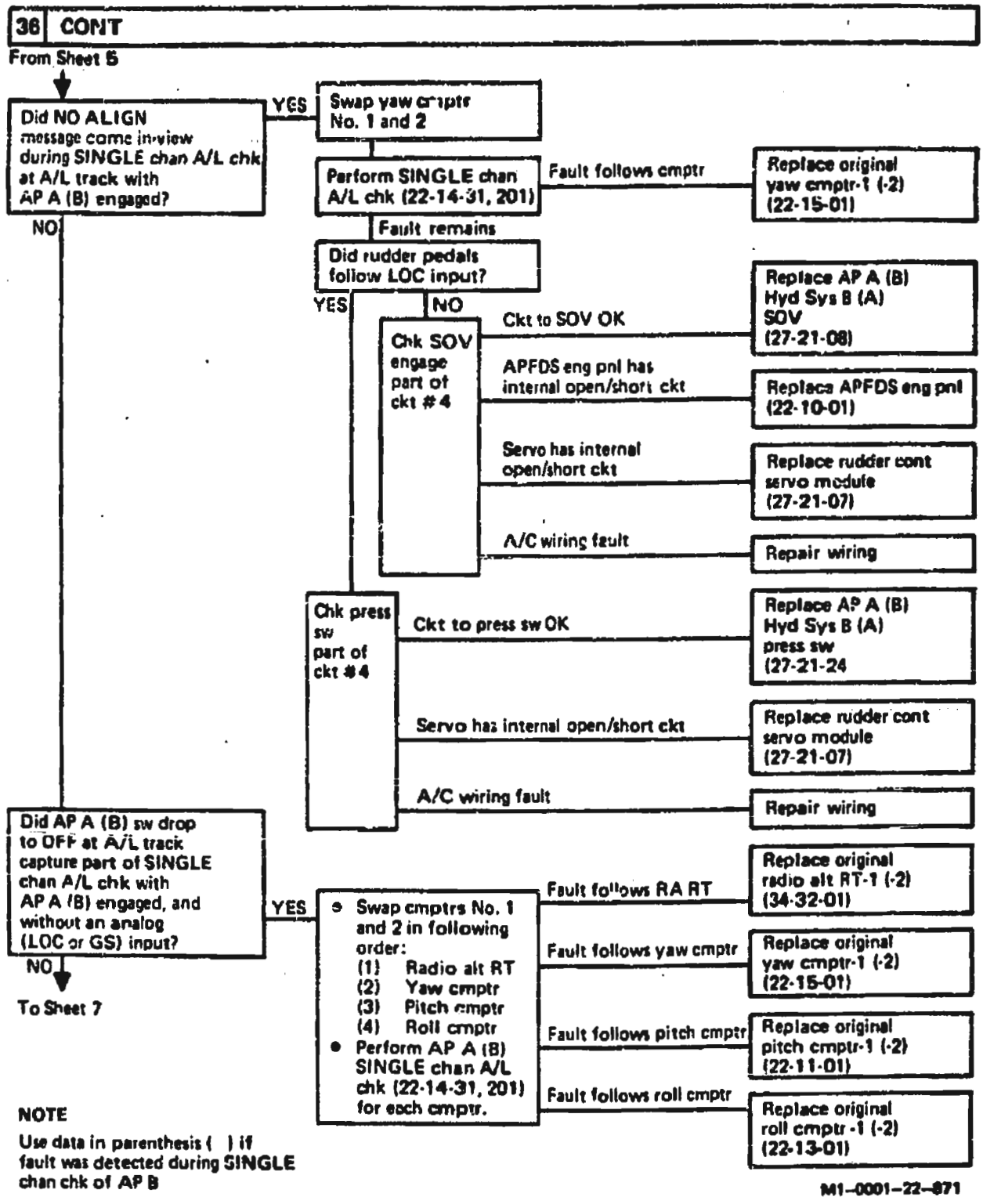
R R EFFECTIVITY: ALL

001B


38 DURING AUTOLAND AT A/L TRACK "NO DUAL" MESSAGE IS DISPLAYED. NO OTHER COCKPIT INDICATIONS. (A "LATCHED DANA" LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED
DUAL CHAN AND SINGLE CHAN A/L TEST PROCEDURES AND TEST EQUIP REQUIRED (22-14-31, 201)
Reset DANA (22-14-31, Fig. 103)
On FCES cmptr: • Chk LATERAL ACCEL FIM
Yes
Blk
Chk ckt #1
Ckt #1 chk OK
• Replace lateral accel (22-13-02). • If problem persists, replace roll cmptr-1 (-2) (22-13-01)
A/C wiring fault
Repair wiring
On FCES cmptr: • Chk NORMAL ACCEL FIM.
Yes
Blk
Chk ckt #2
Ckt #2 chk OK
• Replace normal accel (22-11-02). • If problem persists, replace pitch cmptr-1 (-2) (22-11-01)
A/C wiring fault
Repair wiring
Chk yaw cmptr No.1 and No. 2 FIM
One cmptr FIM wht
Blk
Reset yaw cmptr FIM
Swap yaw cmptr No. 1 and 2
Perform DUAL chan A/L chk (22-14-31, 201) (1)
Replace FIM indicated yaw cmptr-1 (-2) (22-15-01)
FIM fault remains
Chk ckt #3
Ail posn xdcr has internal open/short ckt
Replace L INBD A/L POSN XDCR-1 (-2) (22-13-03)
A/C wiring fault
Repair wiring
• Determine fault symptom and what side fault is on (AP A or AP B) by performing SINGLE chan A/L chk for AP A, then AP B (Ref 22-14-31, 201) • Continue this procedure at fault symptom observed during check
To Sheet 6
NOTE
(1) Look for fault at 1400 ft RA when varying LOC input to operate ailerons
M1-0001-22-885

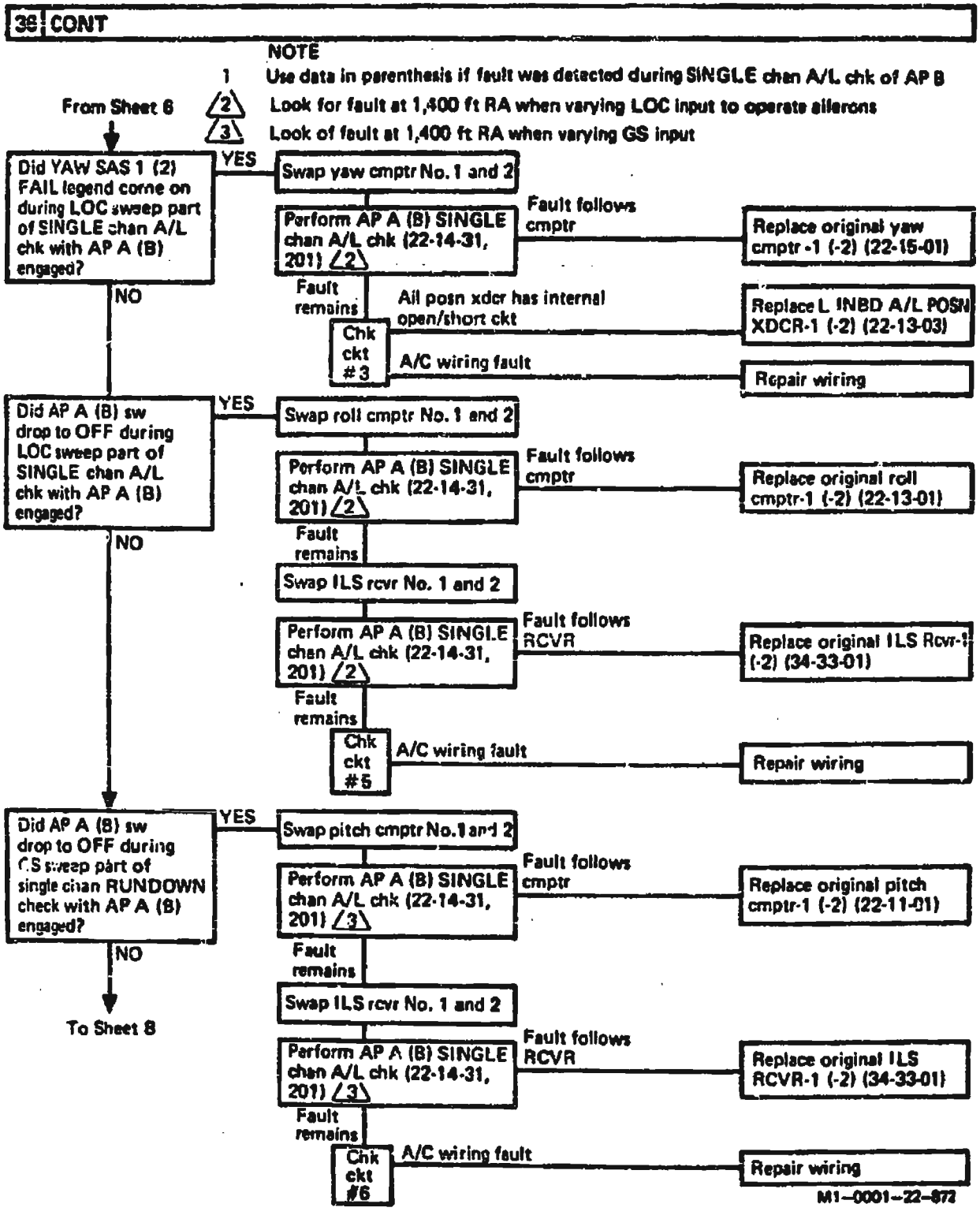
R A/L Track Mode Faults
R Figure 107 (Sheet 5)

R EFFECTIVITY: ALL
R
001B


36 CONT
From Sheet 5
Did NO ALIGN message come in-view during SINGLE chan A/L chk at A/L track with AP A (B) engaged?
YES
Swap yaw cmptr No. 1 and 2
Perform SINGLE chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original yaw cmptr-1 (-2) (22-15-01)
Fault remains
Did rudder pedals follow LOC input?
YES
NO
Chk SOV engage part of ckt #4
Ckt to SOV OK
Replace AP A (B) Hyd Sys B (A) SOV (27-21-08)
APFDS eng pnl has internal open/short ckt
Replace APFDS eng pnl (22-10-01)
Servo has internal open/short ckt
Replace rudder cont servo module (27-21-07)
A/C wiring fault
Repair wiring
Chk press sw part of ckt #4
Ckt to press sw OK
Replace AP A (B) Hyd Sys B (A) press sw (27-21-24
Servo has internal open/short ckt
Replace rudder cont servo module (27-21-07)
A/C wiring fault
Repair wiring
Did AP A (B) sw drop to OFF at A/L track capture part of SINGLE chan A/L chk with AP A (B) engaged, and without an analog (LOC or GS) input?
YES
NO
To Sheet 7
• Swap cmptrs No. 1 and 2 in following order:
(1) Radio alt RT
(2) Yaw cmptr
(3) Pitch cmptr
(4) Roll cmptr
• Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201) for each cmptr.
Fault follows RA RT
Replace original radio alt RT-1 (-2) (34-32-01)
Fault follows yaw cmptr
Replace original yaw cmptr-1 (-2) (22-15-01)
Fault follows pitch cmptr
Replace original pitch cmptr-1 (-2) (22-11-01)
Fault follows roll cmptr
Replace original roll cmptr-1 (-2) (22-13-01)
NOTE
Use data in parenthesis ( ) if fault was detected during SINGLE chan chk of AP B
M1-0001-22-871

R R A/L Track Mode Faults
Figure 107 (Sheet 6)

R R EFFECTIVITY: ALL
001B


38 CONT
NOTE
1 Use data in parenthesis if fault was detected during SINGLE chan A/L chk of AP B
2 Look for fault at 1,400 ft RA when varying LOC input to operate ailerons
3 Look of fault at 1,400 ft RA when varying GS input
From Sheet 6
Did YAW SAS 1 (2) FAIL legend come on during LOC sweep part of SINGLE chan A/L chk with AP A (B) engaged?
YES
Swap yaw cmptr No. 1 and 2
Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201) /2\
Fault follows cmptr
Replace original yaw cmptr-1 (-2) (22-15-01)
Fault remains
Chk ckt #3
All posn xdcr has internal open/short ckt
Replace L INBD A/L POSN XDCR-1 (-2) (22-13-03)
A/C wiring fault
Repair wiring
NO
Did AP A (B) sw drop to OFF during LOC sweep part of SINGLE chan A/L chk with AP A (B) engaged?
YES
Swap roll cmptr No. 1 and 2
Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201) /2\
Fault follows cmptr
Replace original roll cmptr-1 (-2) (22-13-01)
Fault remains
Swap ILS rcvr No. 1 and 2
Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201) /2\
Fault follows RCVR
Replace original ILS Rcvr-1 (-2) (34-33-01)
Fault remains
Chk ckt #5
A/C wiring fault
Repair wiring
NO
Did AP A (B) sw drop to OFF during GS sweep part of single chan RUNDOWN check with AP A (B) engaged?
YES
Swap pitch cmptr No. 1 and 2
Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201) /3\
Fault follows cmptr
Replace original pitch cmptr-1 (-2) (22-11-01)
Fault remains
Swap ILS rcvr No. 1 and 2
Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201) /3\
Fault follows RCVR
Replace original ILS RCVR-1 (-2) (34-33-01)
Fault remains
Chk ckt #6
A/C wiring fault
Repair wiring
To Sheet 8
M1-0001-22-872

A/L Track Mode Faults
Figure 107 (Sheet 7)

EFFECTIVITY: ALL

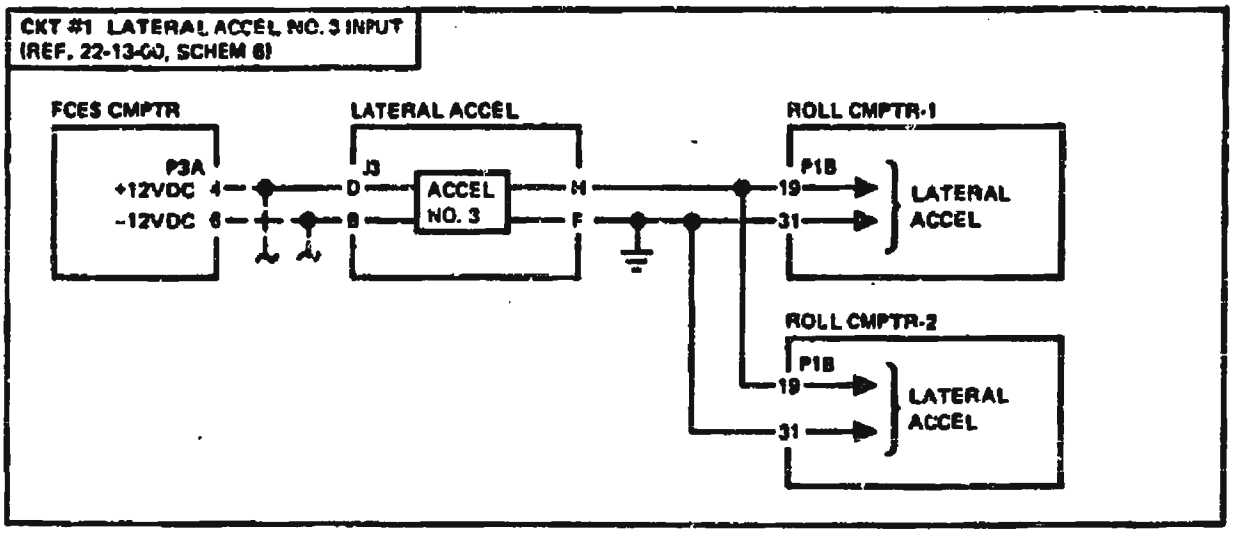
36 CONT

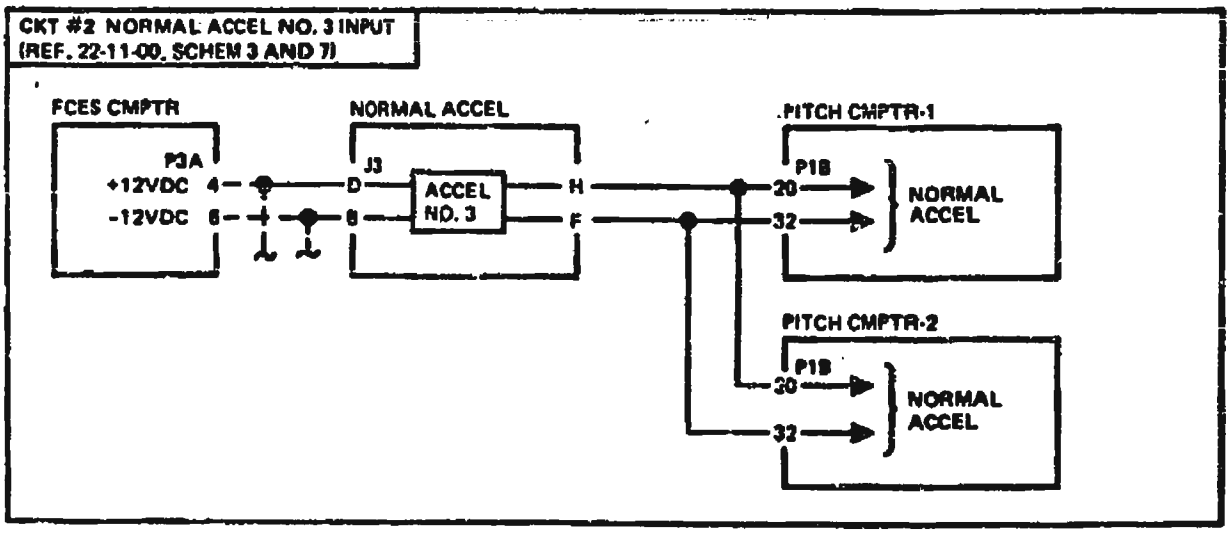
From Sh 7

Perform normal accel and lateral accel checks. (22-00-00, Table 503)

NA chk NOT OK → Replace normal accel unit (22-11-02)

LA chk NOT OK → Replace lateral accel unit (22-13-02)





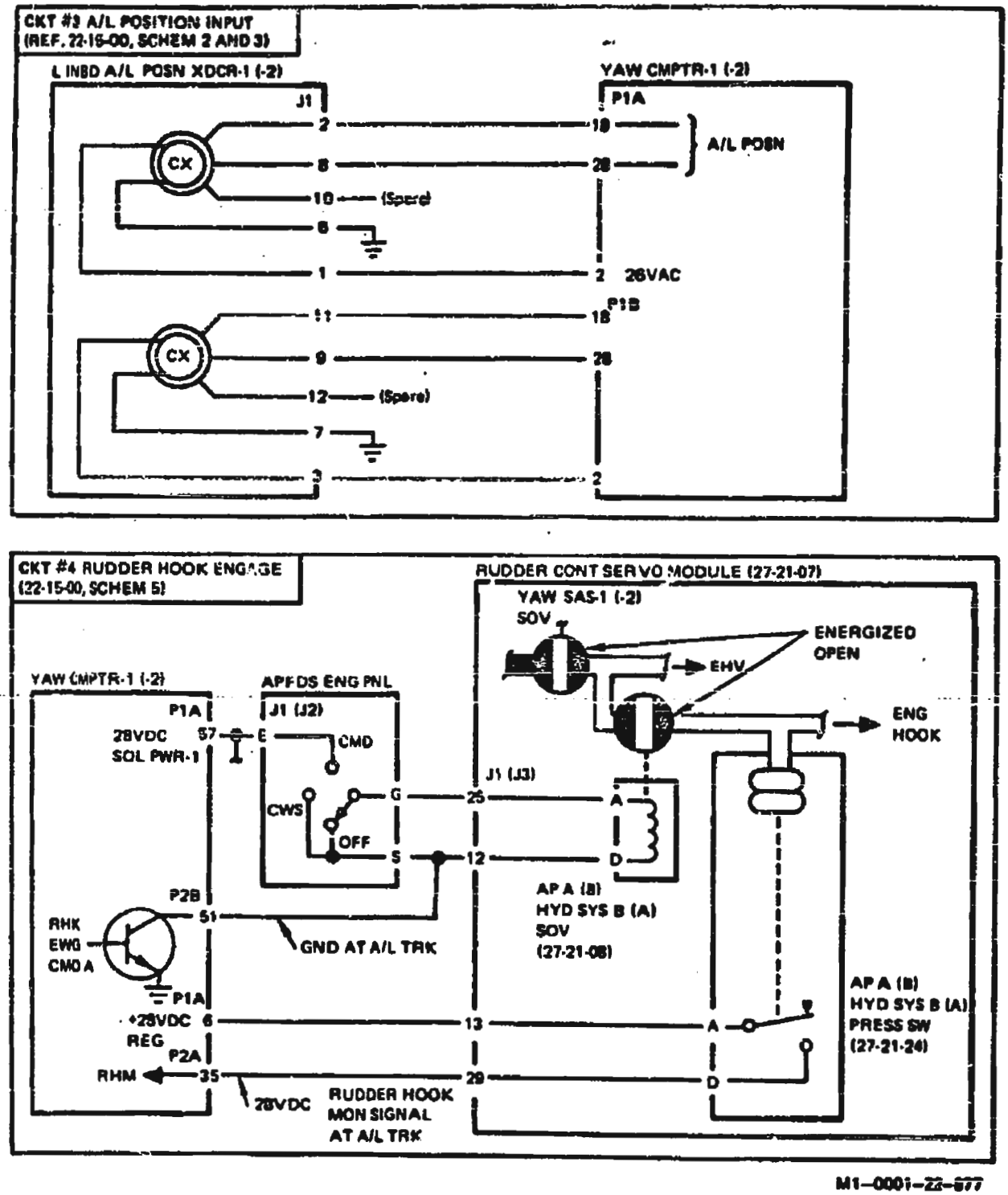
M1-0001-22-876

A/L Track Mode Faults
Figure 107 (Sheet 8)

EFFECTIVITY: ALL

001B

35 CONT

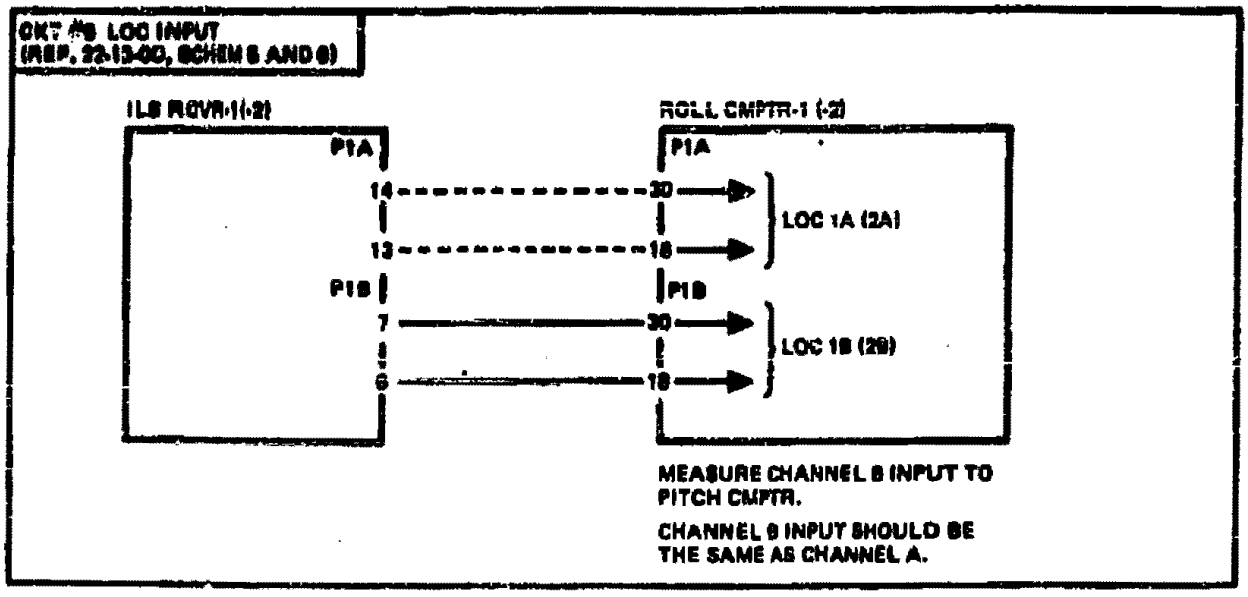


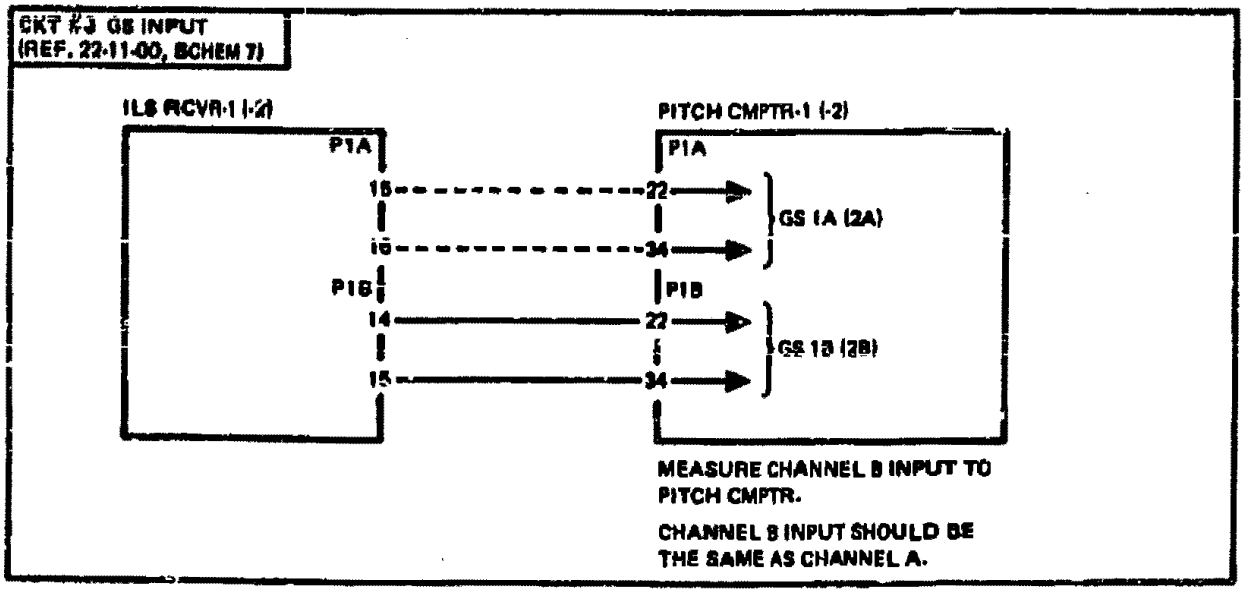
M1-000i-22-577

R A/L Track Mode Faults
R Figure 107 (Sheet 9)

R EFFECTIVITY: ALL
R
001B

36 CONTD





M1-0001-22-879

R A/L Track Mode Faults
R Figure 107 (Sheet 10)

R EFFECTIVITY: ALL
R
001B

37	DURING AUTOLAND AT A/L TRACK, NO DUAL MESSAGE IS DISPLAYED. FD FLAG CAME IN-VIEW ON CAPT (F/O) ADI AFTER A/L TRACK. ONE FLR ARM MESSAGE ON AFCS MODES ANNUNCIATOR (SAME SIDE) BLANK. RADIO ALT INDICATOR (SAME SIDE) READS LESS THAN 50 FEET. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED.)

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (22-14-31, Fig. 103)

Swap radio alt RT No. 1 and 2

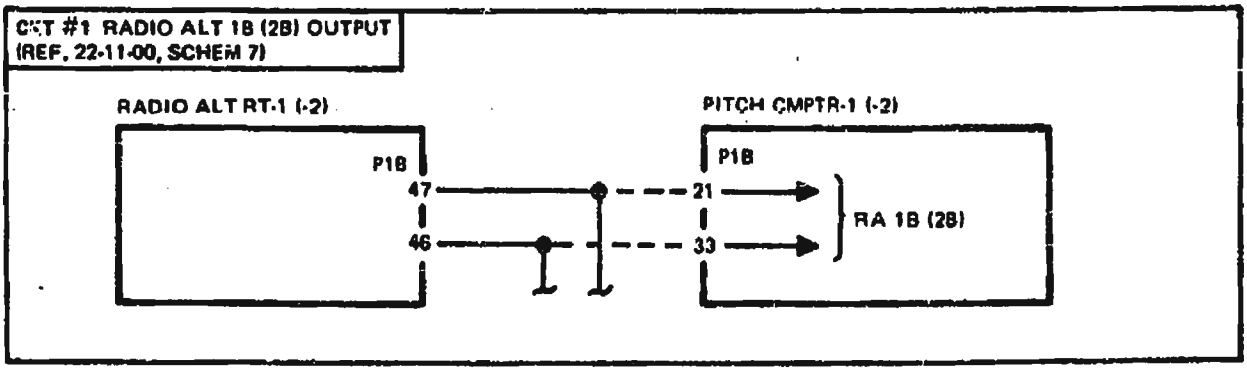
Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows RT → Replace original radio alt RT-1 (-2) (34-32-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring



M1-0003-22-880

A/L Track Mode Faults
Figure 107 (Sheet 11)

R EFFECTIVITY: ALL
R
001B

38	DURING AUTOLAND AT A/L TRACK, "NO DUAL" MESSAGE IS DISPLAYED. "FD" FLAG CAME IN-VIEW ON CAPT (F/O) ADI AFTER A/L TRACK. ONE "FLR ARM" MESSAGE ON AFCS MODES ANNUNCIATOR (SAME SIDE) BLANK. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED)

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (22-14-31, Fig. 103)

Swap pitch cmptr No. 1 and 2

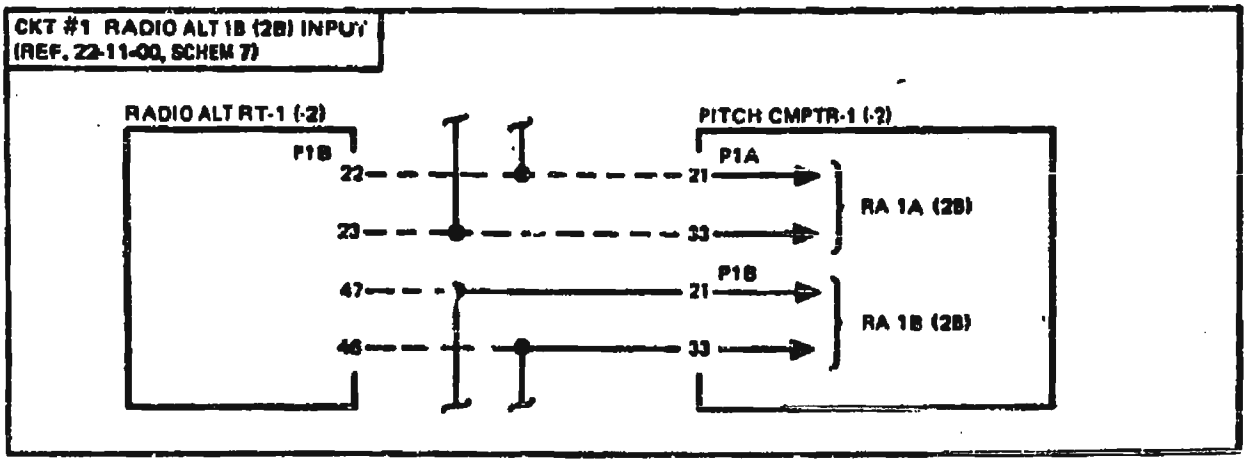
Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains

Cht ckt #1

A/C wiring → Repair wiring



M1-0001-22-00

A/L Track Mode Faults
Figure 107 (Sheet 12)

EFFECTIVITY: ALL

001B

39 DURING AUTOLAND AT A/L TRACK, NO DUAL MESSAGE IS DISPLAYED. FD FLAG CAME IN-VIEW ON CAPT (F/O) ADI AFTER A/L TRACK. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS ON THE AUTOPILOT IS DISCONNECTED)

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (22-14-31, Fig. 103)

Swap roll cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original roll cmptr-1 (-2) (22-13-01)

Fault remains

Swap ILS rcvr, No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows RCVR → Replace original ILS rcvr-1 (-2) (34-33-01)

Fault remains

Swap pitch cmptr No. 1 and 2

Perform DUAL chan A/C chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr -1 (2) (22-11-01)

Fault remains

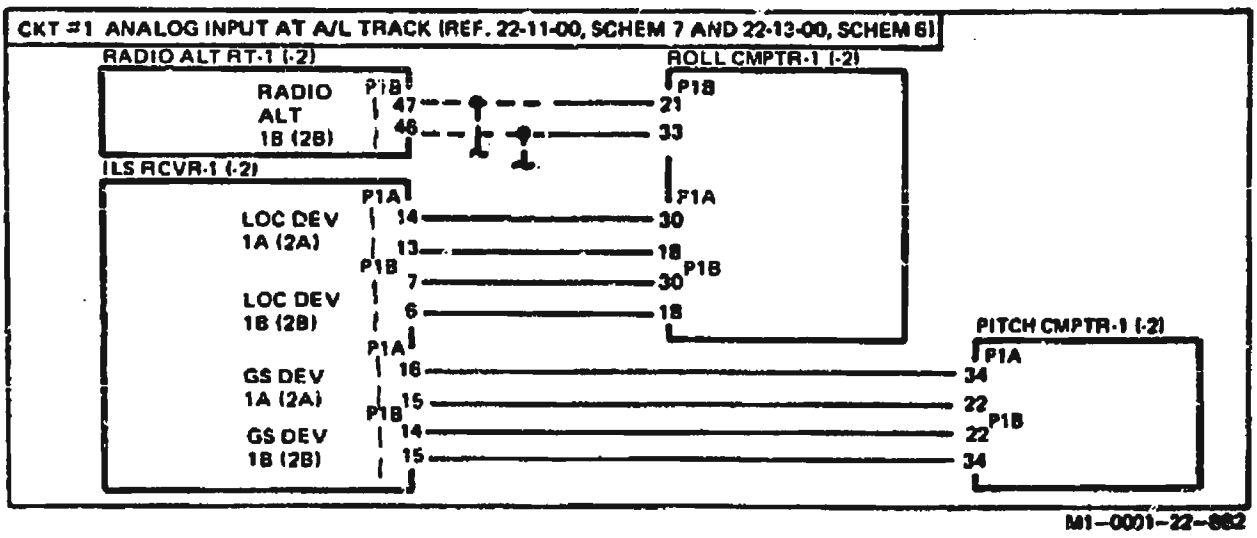
Swap radio alt RT No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows RT → Replace original radio alt RT-1 (-2) (34-32-01)

Fault remains

Chk ckt #1 → A/C wiring fault → Repair wiring

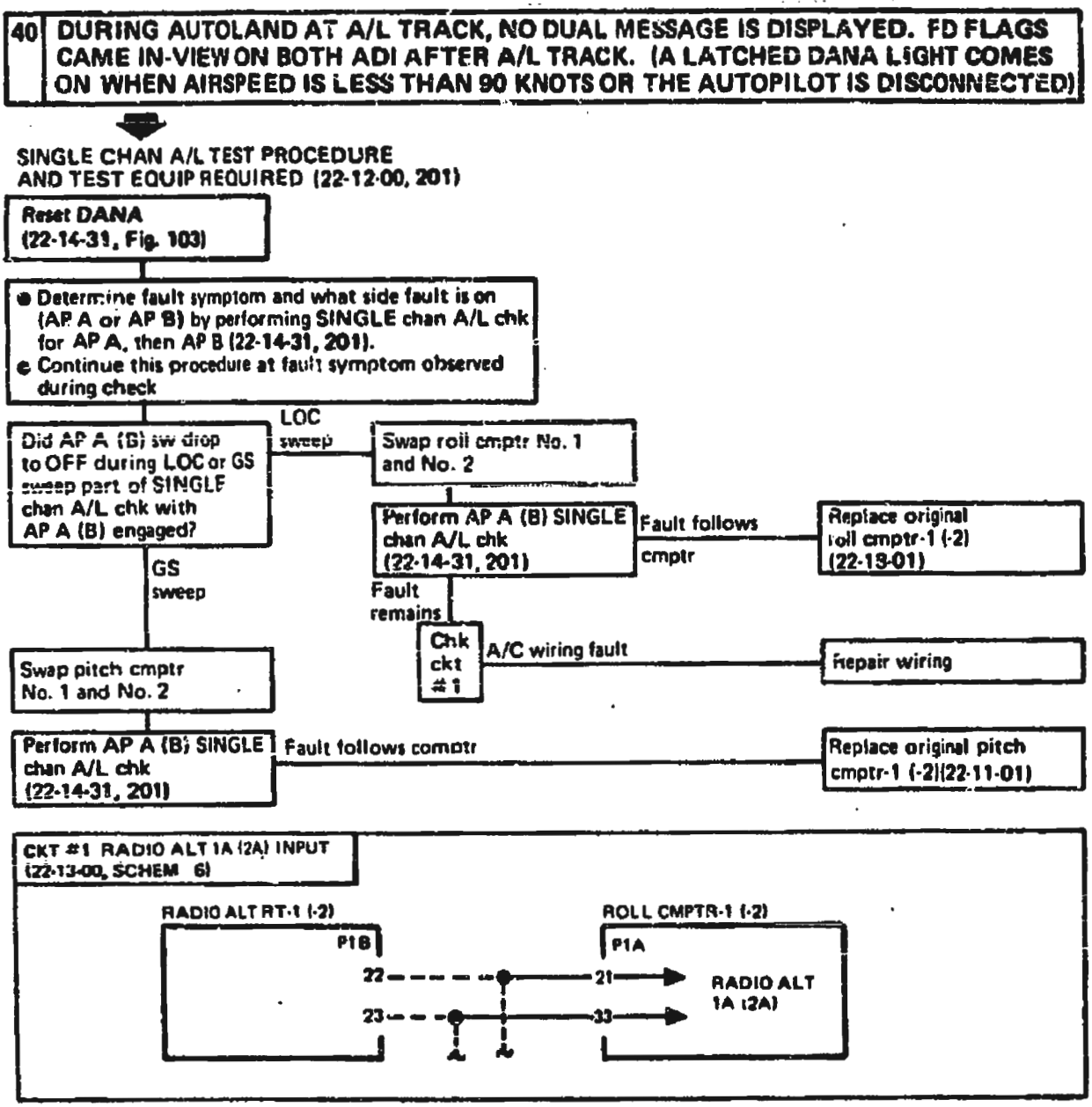


M1-0001-22-662

A/L Track Mode Faults
Figure 107 (Sheet 13)

EFFECTIVITY: ALL

001B


40 DURING AUTOLAND AT A/L TRACK, NO DUAL MESSAGE IS DISPLAYED. FD FLAGS CAME IN-VIEW ON BOTH ADI AFTER A/L TRACK. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED)
SINGLE CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-12-00, 201)
Reset DANA (22-14-31, Fig. 103)
• Determine fault symptom and what side fault is on (AP A or AP B) by performing SINGLE chan A/L chk for AP A, then AP B (22-14-31, 201).
• Continue this procedure at fault symptom observed during check
Did AP A (B) sw drop to OFF during LOC or GS sweep part of SINGLE chan A/L chk with AP A (B) engaged?
LOC sweep
Swap roll cmptr No. 1 and No. 2
Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original roll cmptr-1 (-2) (22-13-01)
Fault remains
Chk ckt #1
A/C wiring fault
Repair wiring
GS sweep
Swap pitch cmptr No. 1 and No. 2
Perform AP A (B) SINGLE chan A/L chk (22-14-31, 201)
Fault follows comptr
Replace original pitch cmptr-1 (-2)(22-11-01)
CKT #1 RADIO ALT 1A (2A) INPUT (22-13-00, SCHEM 6)
RADIO ALT RT-1 (-2)
P1B
22
23
ROLL CMPTR-1 (-2)
P1A
21
33
RADIO ALT 1A (2A)

MI-0001-22-883

A/L Track Mode Faults
Figure 107 (Sheet 14)

EFFECTIVITY: ALL

001B

41 DURING AUTOLAND, AP A(B) DISCONNECT DURING A/L TRACK. NO DUAL MESSAGE IS DISPLAYED. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED.)

NOTE
The usual cause of a single channel disconnect during A/L track is loss of pitch or roll servo monitoring on that side. The associated servo monitoring FIM should annunciate.

When an intermittant disconnect failure occurs, troubleshoot per 22-10-33, Fault [15] . Check continuity and resistance of EHV's, LVDT's, position synchros, etc.)

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (22-14-31, Figure 103)

Chk for assoc servo monitor FIM (side that disconnect occured) of following:
- Pitch cmptr
- Roll cmptr
- Pitch A/P servo (FCES cmptr)
- Roll A/P servo (FCES cmptr)

FIM → GO to 22-10-33 Fault [15]

No FIM

Swap pitch cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains

Swap roll cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains → Go to 22-10-33 Fault [15]

M1-0001-22-885

R A/L Track Mode Faults
R Figure 107 (Sheet 15)

R EFFECTIVITY: ALL

R
001B

42 DURING AUTOLAND BOTH AP DISCONNECT DURING A/L TRACK.

TWO FAULTS EXIST

NOTE

After A/L TRK, FAIL operational logic requires two critical failures before disconnecting the autopilot completely.

A ground station GS or LOC transmitter failure will cause both AP to disconnect.

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Chk and record FIM ind on following
- Pitch cmptr-1 (-2)
- Roll cmptr-1 (-2)
- Yaw cmptr-1 (-2)
- FCES (front pnl)

Engage AP A, then B in HDG and VS modes, and rotate HEADING and VS knobs

AP A or B locked-off or drops to OFF

- Perform trouble shooting per 22-10-33.
- Return to this procedure and go to next step

operation normal

Perform DUAL chan A/L chk (22-14-31, 201)

Fault occurs

Refer to 22-14-31 Fig. 103 for fault symptom observed in this test

M1-0002-22-888

R A/L Track Mode Faults
R Figure 107 (Sheet 16)

EFFECTIVITY: ALL

001B

43	DURING AUTOLAND, A/L CAPTURE ABOVE 1500 FT RADIO ALT 30 SEC AFTER GS CAPTURE. AT A/L TRACK BOTH ALIGN MESSAGES CAME IN-VIEW AND CAPT (F/O) FLR ARM MESSAGE WAS BLANK ON AFCS MODES ANNUNCIATORS. FD FLAGS CAME IN-VIEW ON BOTH ADI. IF IN ATS MODE, THROTTLES RETARD AT A/L TRACK. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED.)

Radio alt analog 1A (2A) open to alt cmptr

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA. (22-14-31, Fig. 103)

Swap radio alt RT No. 1 and 2

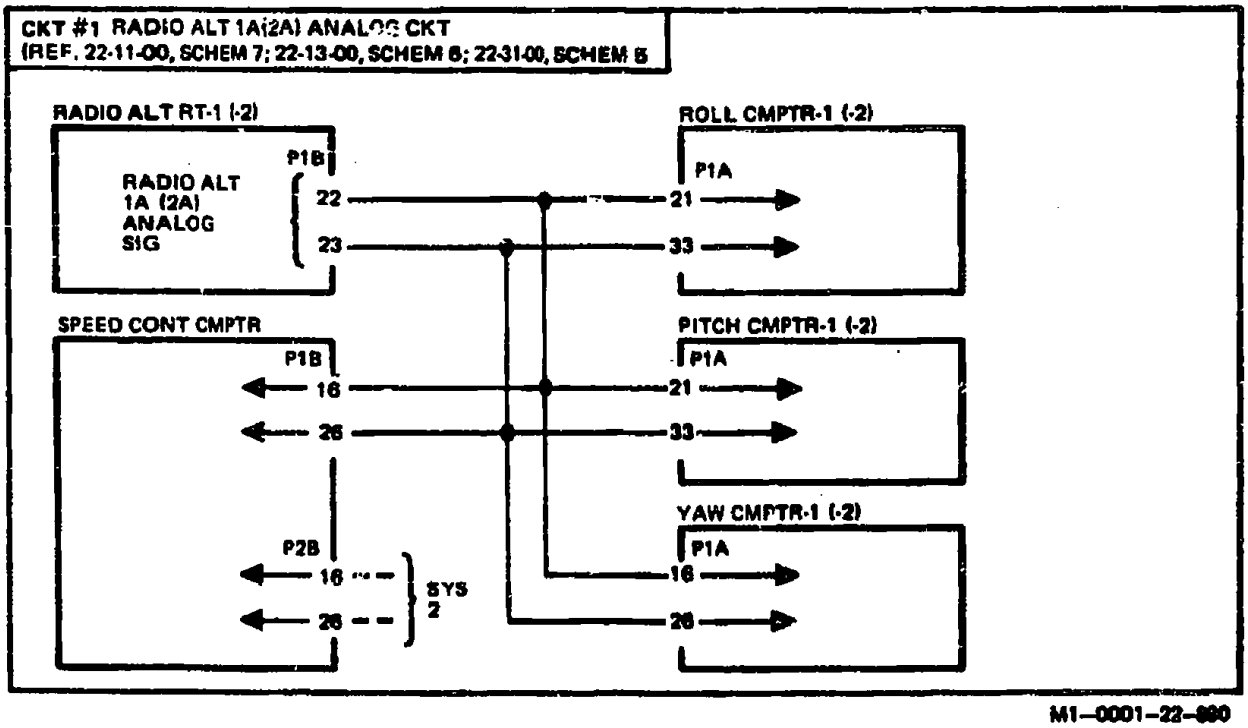
Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace radio alt RT on side with blank FLR ARM message (34-32-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring



M1-0001-22-990

R A/L Track Mode Faults
R Figure 107 (Sheet 17)

R EFFECTIVITY: ALL

R
001B

44	DURING AUTOLAND, A/L CAPTURE ABOVE 1500 FT RADIO ALT 30 SEC AFTER GS CAPTURE. AT A/L TRACK, NO DUAL MESSAGE IS DISPLAYED, AND FLR ARM MESSAGE WAS BLANK ON CAPT (F/O) AFCS MODES ANNUNCIATOR. FD FLAGS CAME IN-VIEW ON BOTH ADI. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED)

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22 14-31, 201)

Reset DANA (22-14-31), Fig. 103)

Swap pitch cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

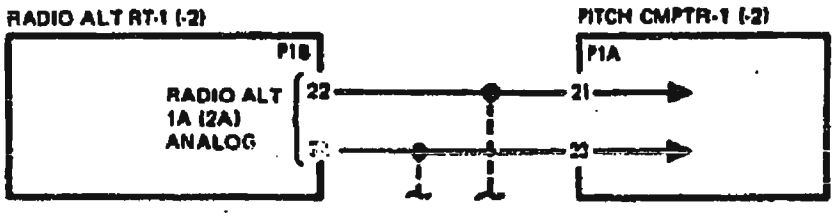
Fault follows cmptr → Replace pitch cmptr on side with blank FLR ARM message (22-11-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring

CKT #1 RADIO ALT 1A (2A) ANALOG INPUT TO PITCH CMPTR (REF. 22-11-00, SCHEM 7)



45	DURING AUTOLAND AFTER A/L CAPTURE, PITCH TRIM 1 (2) FAIL LIGHT CAME ON. FLT CONT PANELS ANNUNCIATOR ON. NO OTHER COCKPIT INDICATIONS

Nose up bias ckt → Replace trim aug cmptr (22-18-01)

M1-0001-22-650

A/L Track Mode Faults
Figure 107 (Sheet 18)

EFFECTIVITY: ALL

001B

46 DURING AUTOLAND AT A/L TRACK, NO DUAL MESSAGE IS DISPLAYED. FD FLAG CAME IN-VIEW ON CAPT (F/O) ADI AFTER A/L TRACK. YAW STEERING POINTER ON ADI (SAME SIDE) DID NOT COME IN-VIEW AT ROLLOUT. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED)

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (22-14-31), Fig. 103)

Swap roll cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original roll cmptr-1 (-2) (22-13-01)

Fault remains

Swap yaw cmptr No. 1 and 2

Perform DUAL chan A/L chk

Fault follows cmptr → Replace original yaw cmptr-1 (-2) (22-15-01)

Fault remains

Swap radio alt RT No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

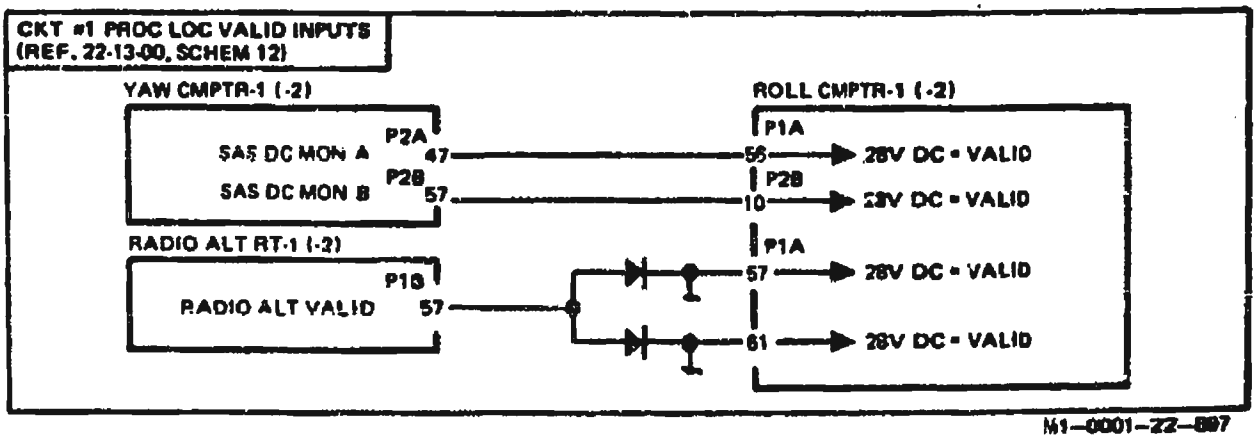
Fault follows RT → Replace original radio alt RT-1 (-2) (34-32-01)

Fault remains

Chk ckt #1

Open diode → Replace diode

A/C wiring fault → Repair wiring



R A/L Track Mode Faults
R Figure 107 (Sheet 19)

R EFFECTIVITY: ALL

R
001B

51 DURING AUTOLAND AT ALIGN, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES ALIGN, OTHER ANNUNCIATOR BLANK. CORRECT MESSAGE COMES IN VIEW DURING AFCS MODES ANNUNCIATOR TEST 1.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Swap yaw cmptr No. 1 and 2.

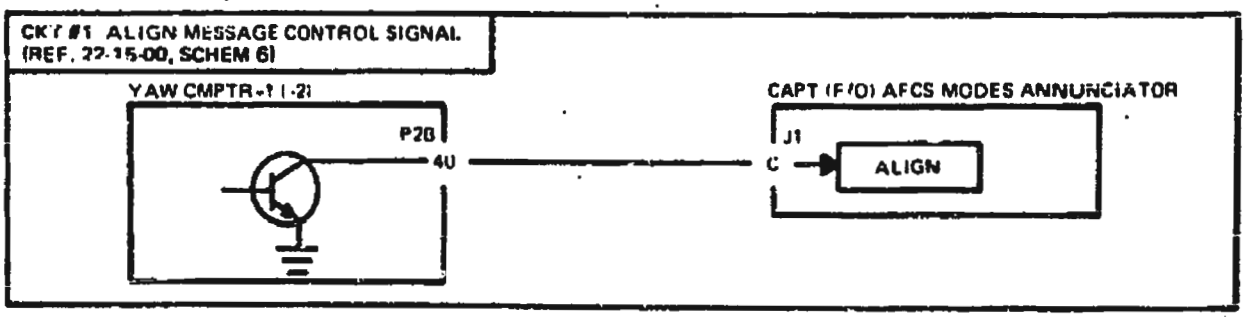
Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original yaw cmptr-1 (-2) (22-15-01).

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring.



52 DURING AUTOLAND, NO ALIGN MESSAGE CAME IN-VIEW AFTER ALIGN.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Replace yaw cmptr-1 with one known to be good.

Perform DUAL chan A/L chk (22-14-31, 201)

Fault cleared → Replace original yaw cmptr-1 (22-15-01).

Fault remains → Replace yaw cmptr-2 (22-15-01).

M1-0001-22-804

A/L ALIGN Mode Faults
Figure 108 (Sheet 1)

EFFECTIVITY: ALL

001B

53 DURING AUTOLAND AT ALIGN, NO DUAL MESSAGE IS DISPLAYED. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTOPILOT IS DISCONNECTED.

SINGLE CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (22-14-31, Fig. 103)

- Determine what side fault is on (AP A or AP B) by performing SINGLE chan A/L chk for AP A, then AP B (22-14-31, 201)
- Bat handle will drop to OFF on faulted side.

Swap roll cmptr No. 1 and 2.

Perform SINGLE chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original roll cmptr-1 (-2) (22-13-01)

Fault remains

Swap yaw cmptr No. 1 and 2.

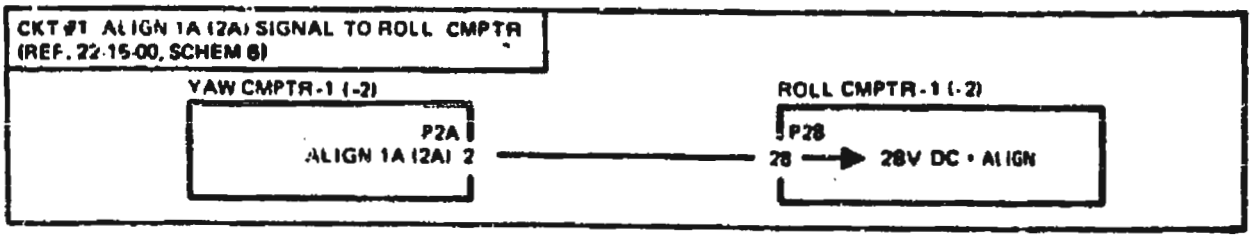
Perform SINGLE chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original yaw cmptr-1 (-2) (22-15-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring



M1-0001-22-005

A/L ALIGN Mode Faults
Figure 108 (Sheet 2)

EFFECTIVITY: ALL

0018

54	DURING AUTOLAND AT ALIGN, NO DUAL MESSAGE IS DISPLAYED. CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES ALIGN, OTHER ANNUNCIATOR BLANK. (A LATCHED DANA LIGHT COMES ON WHEN AIRSPEED IS LESS THAN 90 KNOTS OR THE AUTO PILOT IS DISCONNECTED.)

Fault is on side with blank ALIGN ann. → *Replace yaw cmptr-1 (-2) (22-15-01)*

M1-0000-22-806

R A/L ALIGN Mode Faults
R Figure 108 (Sheet 3)

R EFFECTIVITY: ALL
R
0018

56 DURING AUTOLAND, AP A (B) DISCONNECT DURING ALIGN OR FLARE OR ROLLOUT. DANA RECALL

NOTE
The usual cause of a single channel disconnect after A/L track is loss of pitch or roll servo monitoring on that side. The associated servo monitoring FIM should annunciate.

When an intermittant disconnect failure occurs, troubleshoot per 22-10-33 Fault [15] . Check continuity and resistance of EHV's, LVDT's, position synchros, etc.)

DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA. (22-14-00, Fig. 103)

Chk for assoc servo monitor FIM (side that disconnect occured) of following:
- Pitch cmptr
- Roll cmptr
- Pitch A/P servo (FCES cmptr)
- Roll A/P servo (FCES cmptr)

FIM → GO to 22-10-33 Fault [15]

No FIM

Swap pitch cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains

Swap roll cmptr No. 1 and 2

Perform DUAL chan A/L chk (22-14-31, 201)

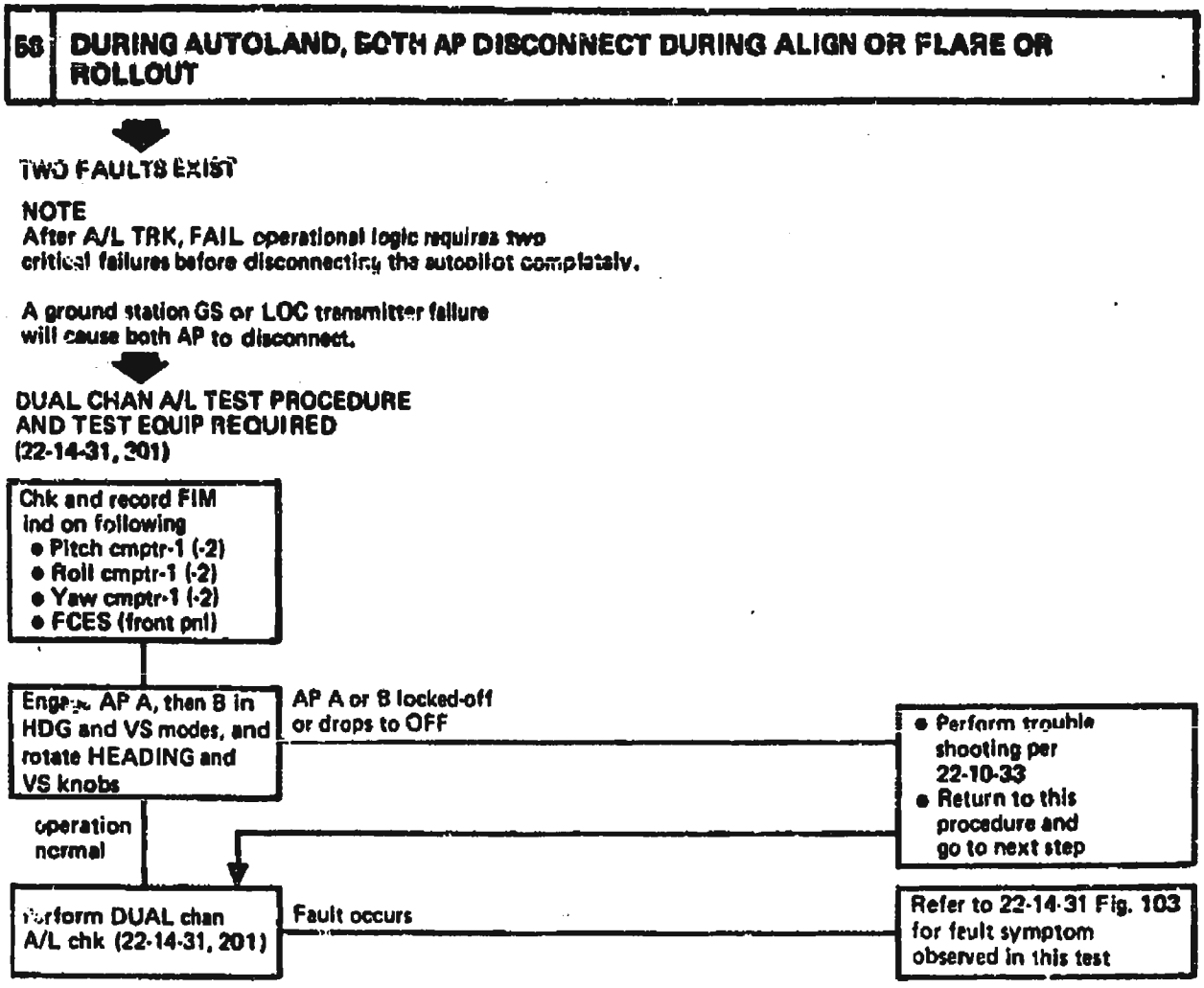
Fault follows cmptr → Replace original roll cmptr-1 (-2) (22-13-01)

Fault remains → Go to 22-10-33 Fault [15]

M1-0001-22-908

A/L ALIGN Mode Faults
Figure 108 (Sheet 4)

EFFECTIVITY: ALL


58 DURING AUTOLAND, BOTH AP DISCONNECT DURING ALIGN OR FLARE OR ROLLOUT
TWO FAULTS EXIST
NOTE
After A/L TRK, FAIL operational logic requires two critical failures before disconnecting the autopilot completely.
A ground station GS or LOC transmitter failure will cause both AP to disconnect.
DUAL CHAN A/L TEST PROCEDURE AND TEST EQUIP REQUIRED (22-14-31, 201)
Chk and record FIM ind on following
• Pitch cmptr-1 (-2)
• Roll cmptr-1 (-2)
• Yaw cmptr-1 (-2)
• FCES (front pnl)
Engage AP A, then B in HDG and VS modes, and rotate HEADING and VS knobs
AP A or B locked-off or drops to OFF
• Perform trouble shooting per 22-10-33
• Return to this procedure and go to next step
operation normal
Perform DUAL chan A/L chk (22-14-31, 201)
Fault occurs
Refer to 22-14-31 Fig. 103 for fault symptom observed in this test

M1-0002-22-909

R A/L ALIGN Mode Faults
R Figure 108 (Sheet 5)

EFFECTIVITY: ALL

001B

61 DURING AUTOLAND AT FLARE, ATS DISC MESSAGE AND BOTH ATS FAIL LIGHTS ON.

One chan of speed cmptr not in flare mode.

→ Replace speed cont cmptr (22-31-07)

62 DURING AUTOLAND AT FLARE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES FLARE, OTHER ANNUNCIATOR BLANK. CORRECT MESSAGE COMES IN-VIEW DURING AFCS MODES ANNUNCIATOR TEST 1. DANA RECALL.

Pitch cmptr FLARE fault.

- Loss of FLARE A or B in one cmptr at FLARE alt. or
- DANA during ground test at FLARE alt. or TD because of loss of one ND signal

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Reset DANA (Fig. 103)

Swap pitch cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-10-33, 201)

Fault follows cmptr → Replace original pitch cmptr -1 (-2) (22-11-01)

M1-0001-22-916

R A/L FLARE Mode Faults
R Figure 109 (Sheet 1)

R EFFECTIVITY: ALL
R
001B

63 DURING AUTOLAND AT FLARE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES FLARE, OTHER ANNUNCIATOR BLANK. CORRECT MESSAGE COMES IN-VIEW DURING AFCS MODES ANNUNCIATOR TEST 1. NO OTHER COCKPIT INDICATIONS.

DUAL CHAN A/L TEST PROCEDURE
& TEST EQUIP REQUIRED
(22-14-31, PAGE 201)

Swap pitch cmptr No. 1 and 2.

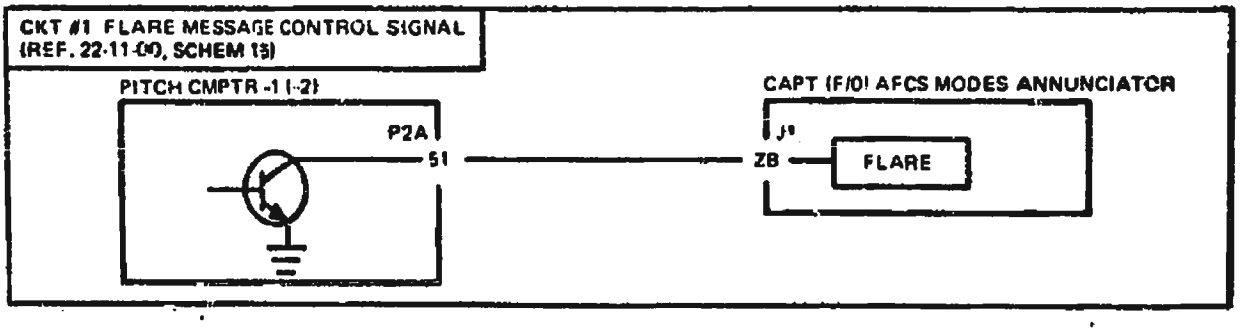
Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr -1 (-2) (22-11-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring



64 DURING AUTOLAND AT FLARE, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES FLARE, OTHER ANNUNCIATOR BLANK AND THEN INDICATES FLARE APPROX. 5 FT LOWER THAN FLARE ALTITUDE. DANA RECALL.

DUAL CHAN A/L TEST PROCEDURE
& TEST EQUIPMENT REQUIRED
(22-14-31, PAGE 201)

Reset DANA (Fig. 101)

Swap pitch cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original pitch cmptr -1 (-2) (22-11-01)

FLARE | | at flare

FLARE | FLARE approx 5 ft lower

One pitch chan not rate limited

M1-0001-22-919

R R A/L FLARE Mode Faults
Figure 109 (Sheet 2)

R R EFFECTIVITY: ALL

001B

71 DURING AUTOLAND AT ROLLOUT, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES ROLLOUT, OTHER ANNUNCIATOR IS BLANK. CORRECT MESSAGE COMES IN-VIEW DURING AFCS MODES ANNUNCIATOR TEST 1. DANA RECALL.

→ Replace yaw cmptr-1 (-2) (22-15-01)

72 DURING AUTOLAND AT ROLLOUT, CAPT (F/O) AFCS MODES ANNUNCIATOR INDICATES ROLLOUT, OTHER ANNUNCIATOR IS BLANK. CORRECT MESSAGE COMES IN-VIEW DURING AFCS MODES ANNUNCIATOR TEST 1.

→ DUAL CHAN A/L TEST PROCEDURES & TEST EQUIP REQUIRED (22-14-31, 201)

Swap yaw cmptr No. 1 and 2.

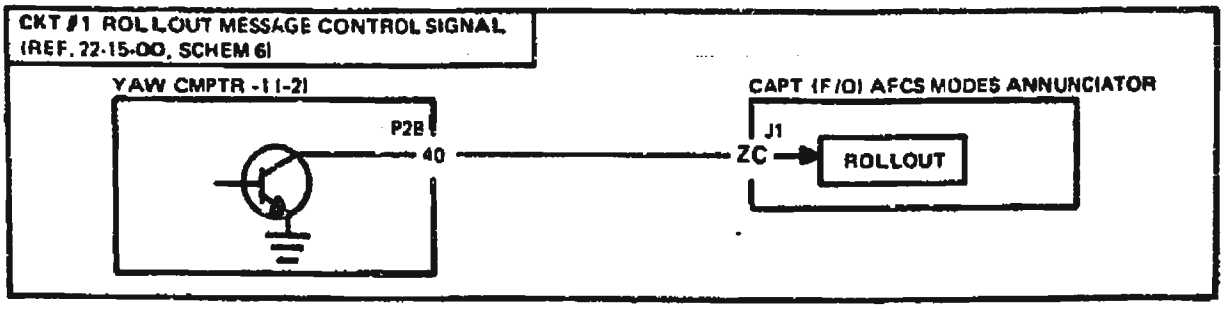
Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original yaw cmptr -1 (-2) (22-15-01)

Fault remains

Chk ckt #1

A/C wiring fault → Repair wiring



M1-0001-22-924

R R A/L ROLLOUT Mode Faults
Figure 110 (Sheet 1)

R R 001B EFFECTIVITY: ALL

75 DURING AUTOLAND AT ROLLOUT, CAPT (F/O) ADI YAW STEERING POINTER INOPERATIVE AND R/O FLAG IN-VIEW. NO OTHER COCKPIT INDICATIONS.

→ Replace Capt (F/O) ADI (34-21-07)

76 DURING AUTOLAND AT ROLLOUT, CAPT (F/O) ADI YAW STEERING POINTER INOPERATIVE. NO OTHER COCKPIT INDICATIONS.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Swap yaw cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201)

Fault follows cmptr → Replace original yaw cmptr -1 (-2) (22-15-01)

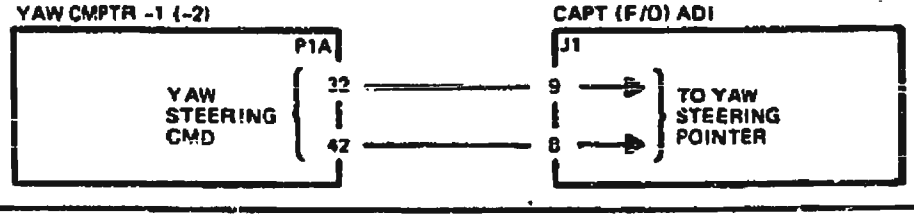
Fault remains

Chk ckt #1

Ckt #1 chk OK → Replace Capt (F/O) ADI (34-21-07)

A/C wiring fault → Repair wiring

CKT #1 YAW STEERING CMD (REF. 22-15-00, SCHEM 4)



M1-0001-22-928

R A/L ROLLOUT Mode Faults
R Figure 110 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

77 DURING AUTOLAND AT ROLLOUT, CAPT (F/O) ADI YAW STEERING POINTER REMAINED OUT-OF-VIEW. DANA RECALL.

DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)

Suspect:
- Proc nav valid.
- Loss of 1 chan of ail X-feed due to bad HDG.
- Loss of 1 chan of proc R/O cmd at LOC sweep.

Reset DANA (22-14-00, Fig. 103)

Chk yaw cmptr -1 (-2) FIM — Wht → Replace yaw cmptr -1 (-2) (22-15-01)

Blk

Chk roll cmptr -1 (-2) FIM — Wht → Replace roll cmptr -1 (-2) (22-13-01)

Blk

Swap yaw cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows cmptr → Replace original yaw cmptr -1 (-2) (22-15-01)

Fault remains

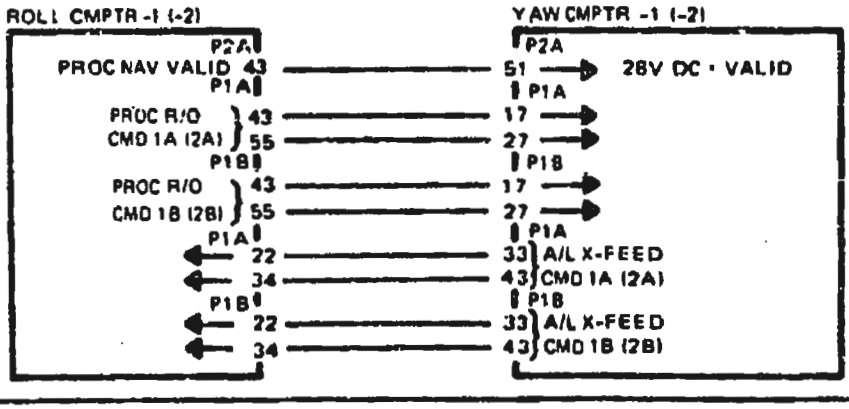
Swap roll cmptr No. 1 and 2.

Perform DUAL chan A/L chk (22-14-31, 201) — Fault follows cmptr → Replace original roll cmptr -1 (-2) (22-13-01)

Fault remains

Chk ckt #1 — A/C wiring fault → Repair wiring

CKT #1 ROLL/YAW CROSS TALK (REF. 22-15-00, SCHEM 4, 7)



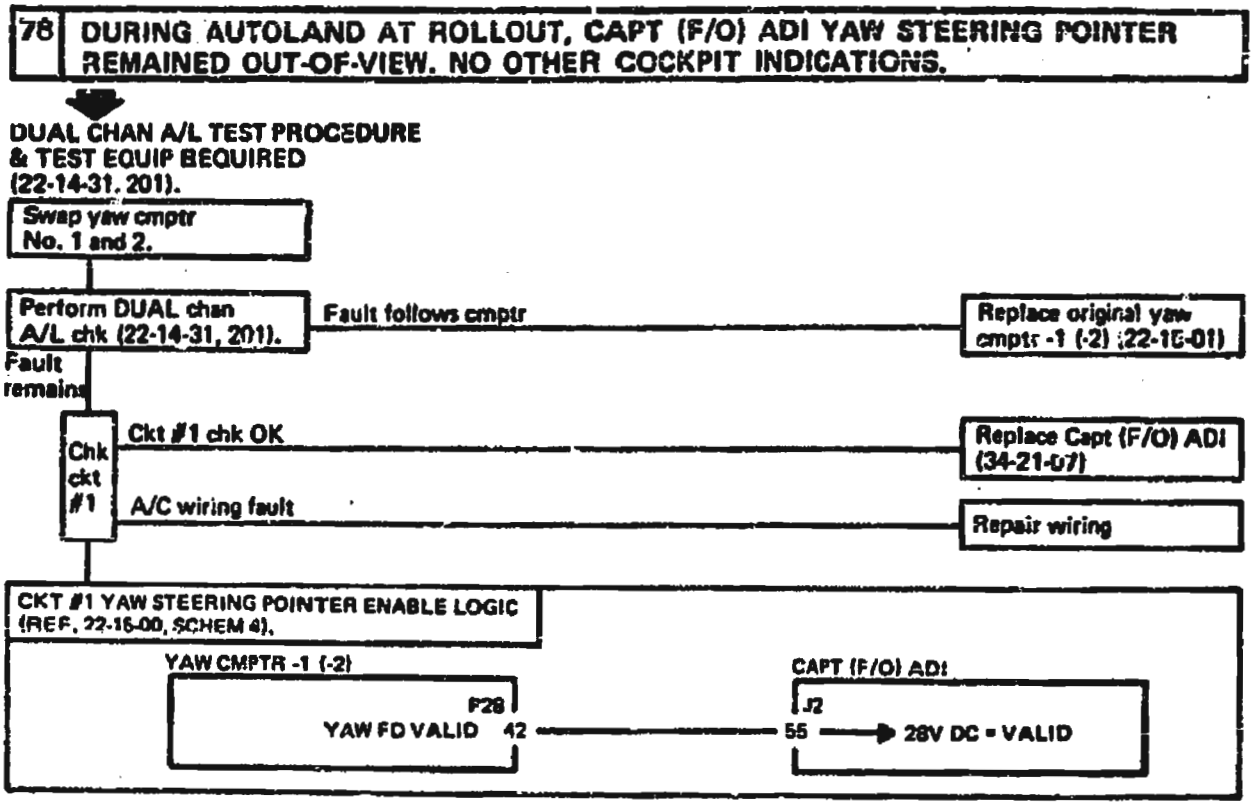
NOTE

If unable to duplicate FAULT:
- Set in a difference of 15 degrees between A/C HDG and COURSE set in.
- Perform DUAL chan A/L chk with following exception at align wait 1 minute before LOC sweep.
  - At ALIGN altituds, if DANA light on before LOC sweep decrab memory in yaw cmptr is fault.
  - At ALIGN altitude, if DANA during LOC sweep — sweep yaw, then roll cmptrs.

M1-0001-22-928

R R A/L ROLLOUT Mode Faults
Figure 110 (Sheet 3)

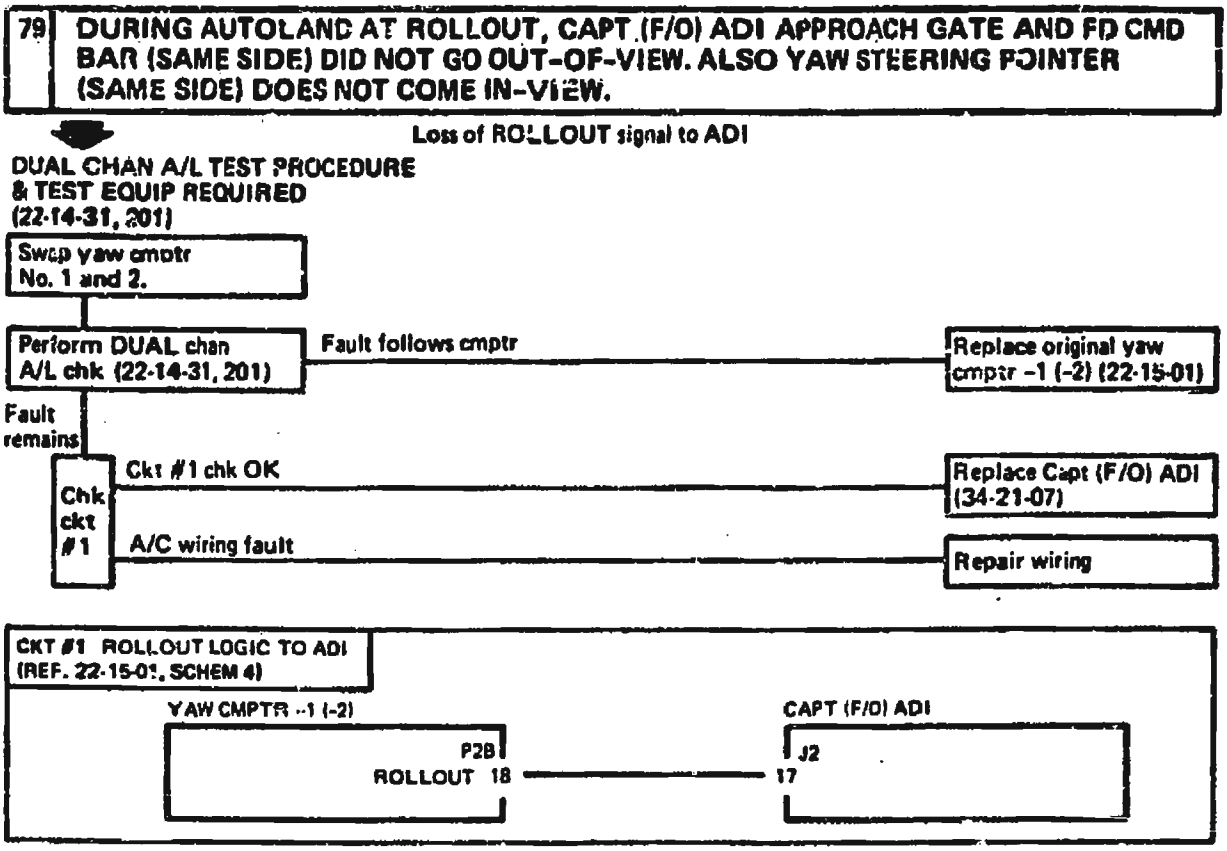
R EFFECTIVITY: ALL
R R
001B


78
DURING AUTOLAND AT ROLLOUT, CAPT (F/O) ADI YAW STEERING POINTER REMAINED OUT-OF-VIEW. NO OTHER COCKPIT INDICATIONS.
DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201).
Swap yaw cmptr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201).
Fault follows cmptr
Replace original yaw cmptr -1 (-2) (22-16-01)
Fault remains
Chk ckt #1
Ckt #1 chk OK
Replace Capt (F/O) ADI (34-21-07)
A/C wiring fault
Repair wiring
CKT #1 YAW STEERING POINTER ENABLE LOGIC (REF. 22-16-00, SCHEM 4).
YAW CMPTR -1 (-2)
P28
YAW FD VALID 42
CAPT (F/O) ADI
J2
55
28V DC = VALID

M1-0001-22-020

R A/L ROLLOUT Mode Faults
R Figure 110 (Sheet 4)

R EFFECTIVITY: ALL
R
001B


79 DURING AUTOLAND AT ROLLOUT, CAPT (F/O) ADI APPROACH GATE AND FD CMD BAR (SAME SIDE) DID NOT GO OUT-OF-VIEW. ALSO YAW STEERING POINTER (SAME SIDE) DOES NOT COME IN-VIEW.
Loss of ROLLOUT signal to ADI
DUAL CHAN A/L TEST PROCEDURE & TEST EQUIP REQUIRED (22-14-31, 201)
Swap yaw cmptr No. 1 and 2.
Perform DUAL chan A/L chk (22-14-31, 201)
Fault follows cmptr
Replace original yaw cmptr -1 (-2) (22-15-01)
Fault remains
Chk ckt #1
Ckt #1 chk OK
Replace Capt (F/O) ADI (34-21-07)
A/C wiring fault
Repair wiring
CKT #1 ROLLOUT LOGIC TO ADI (REF. 22-15-01, SCHEM 4)
YAW CMPTR -1 (-2)
P2B
ROLLOUT 18
CAPT (F/O) ADI
J2
17

M1-0001-22-930

A/L ROLLOUT Mode Faults
Figure 110 (Sheet 5)

EFFECTIVITY: ALL

001B

01 DURING AUTOLAND AT ROLLOUT, NOSE IS SLOW GETTING DOWN TO GROUND. DANA RECALL.

One pitch cmptr does not go nose down at touchdown.

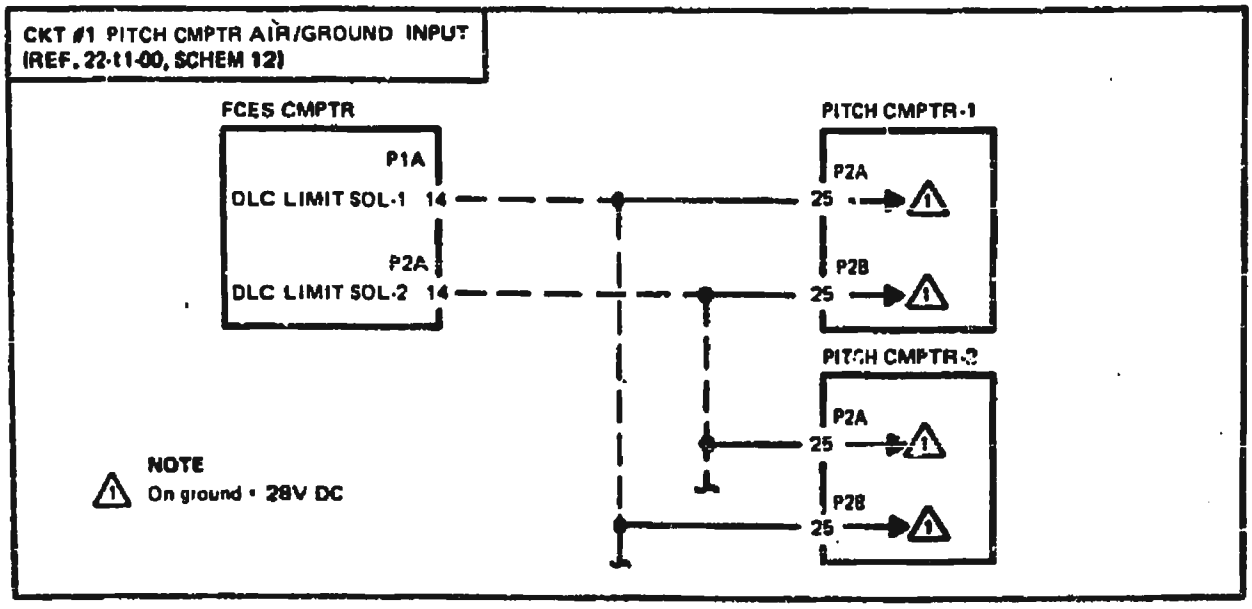
Engage both FD in TAKEOFF mode.

Capt (F/O) AFCS MODES ann displays GO AROUND, other ann TAKEOFF

Swap pitch cmptr No. 1 and 2.

Engage both FD in TAKEOFF mode. — Fault follows cmptr → Replace original pitch cmptr-1 (-2) (22-11-01)

Fault remains → Chk ckt # 1 — A/C wiring fault → Repair wiring



M1-0001-22-932

A/L Touchdown to Ramp Faults
Figure 111 (Sheet 1)

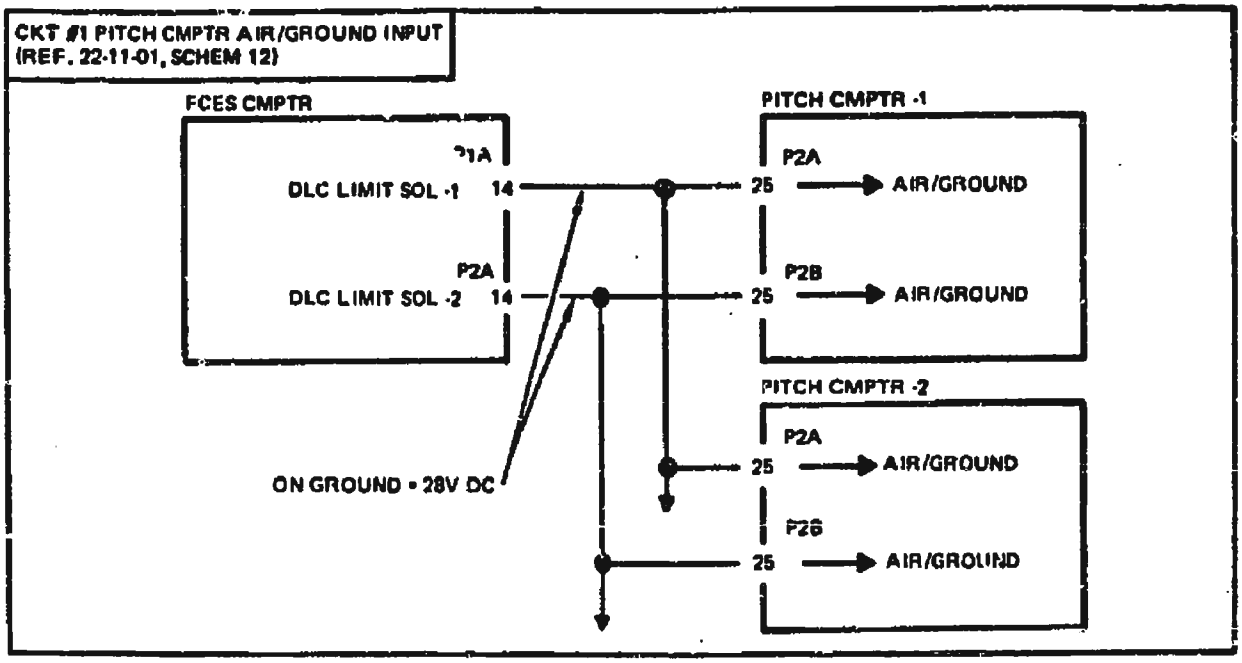
EFFECTIVITY: ALL

92 DURING AUTOLAND AT ROLLOUT, NOSE IS SLOW GETTING DOWN TO GROUND. NO OTHER COCKPIT INDICATIONS.

Both pitch cmptr do not go ND during TD

Chk Ckt #1

- Ckt #1 chk OK → Replace FCES cmptr. (22-17-01)
- A/C wiring fault → Repair wiring.



93 DURING AUTOLAND AT TOUCHDOWN, ATS DISC MESSAGE WITH BOTH ATS FAIL LIGHTS ON. NO OTHER COCKPIT INDICATIONS.

One TD bias sw not set → Replace speed cont cmptr (22-31-07)

94 DURING AUTOLAND AT TOUCHDOWN, CAPT (F/O) ATS DISC MESSAGE AFTER THROT RETARD TO IDLE POSITION, AND ATS SWITCH DROPS TO OFF.

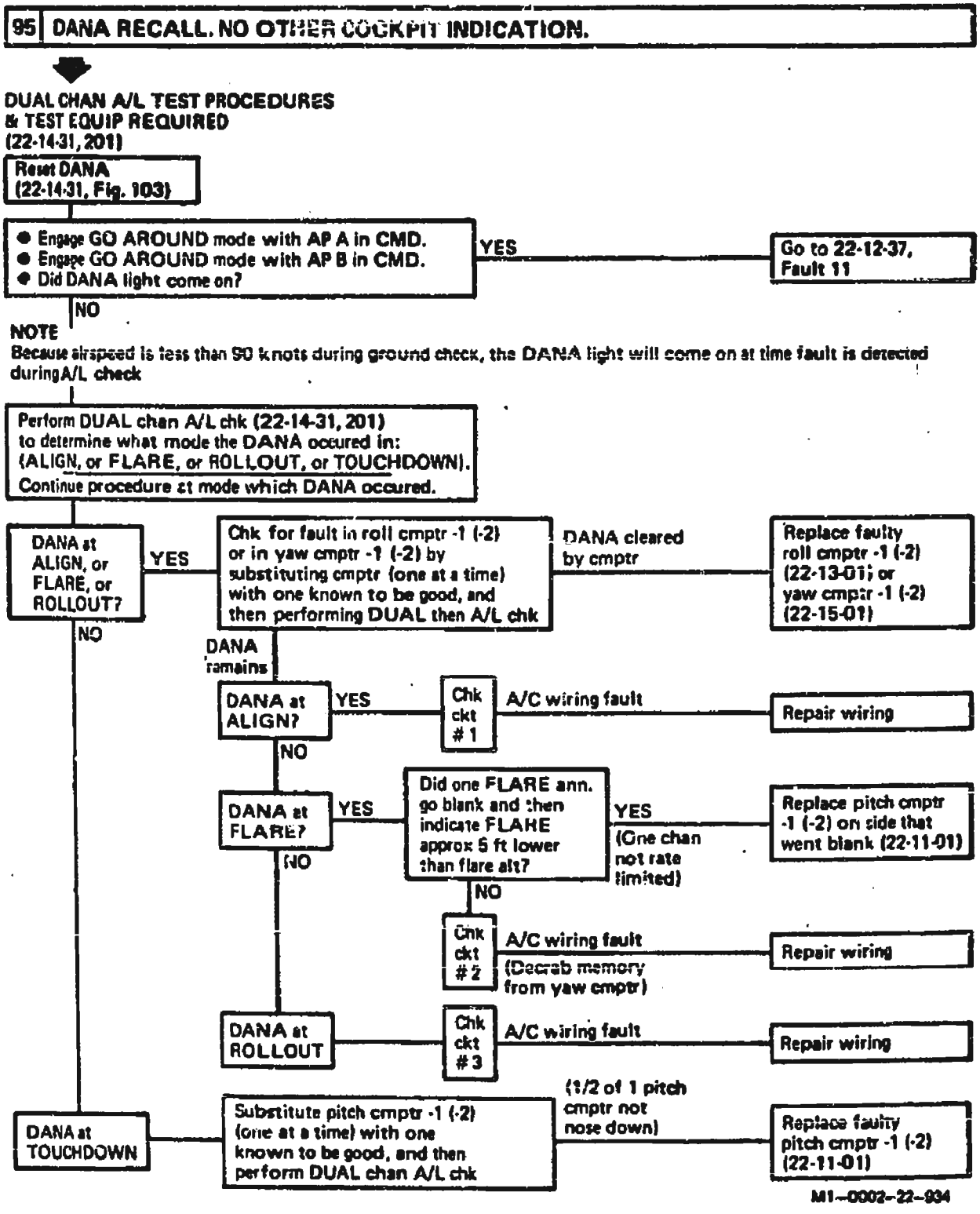
Loss of IDLE A (B) to inhibit ATS DISC missing → Replace speed cont cmptr (22-31-07)

M1-0001-22-933

R R A/L Touchdown to Ramp Faults
Figure 111 (Sheet 2)

R R EFFECTIVITY: ALL

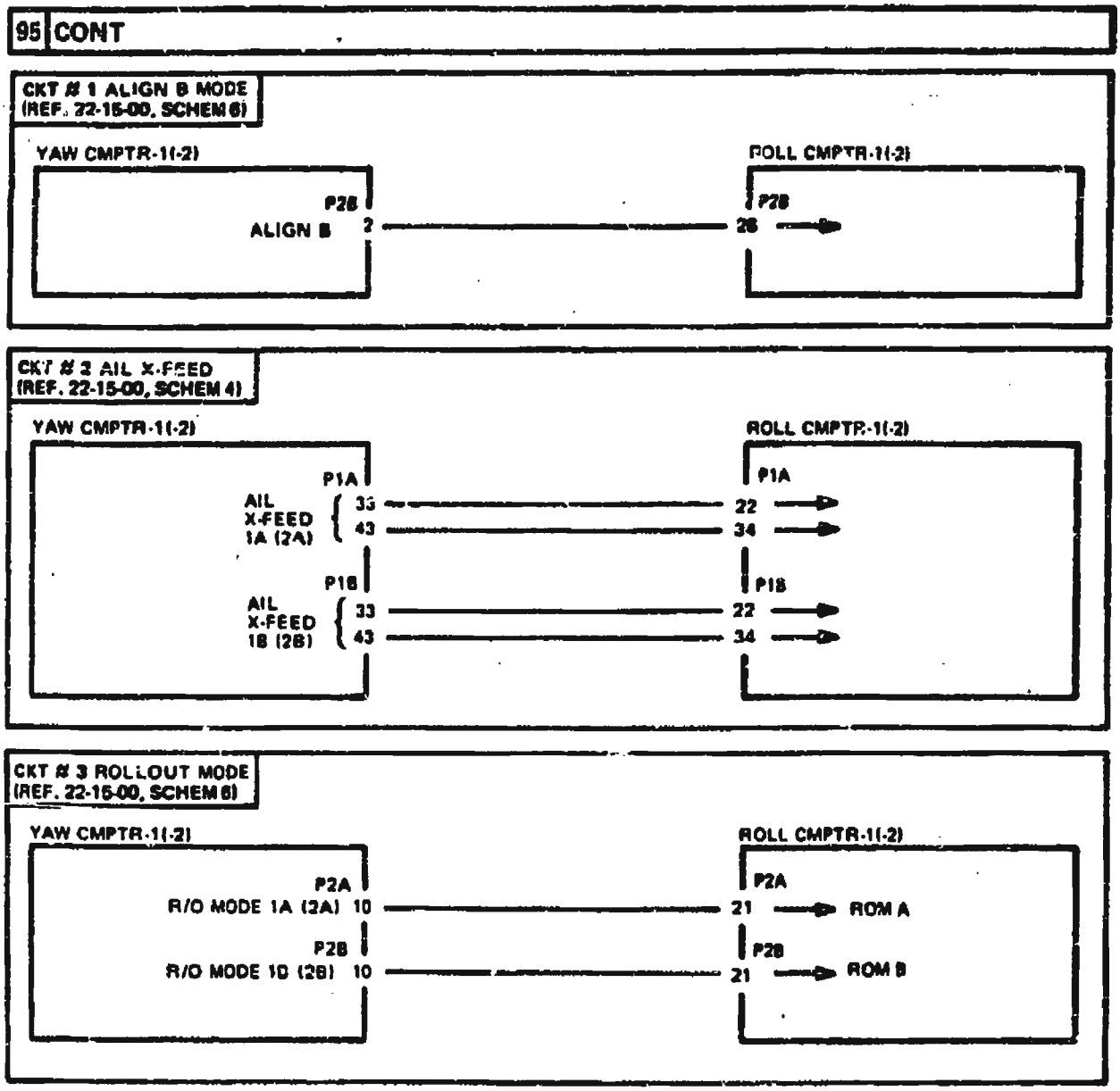
001B


95 DANA RECALL. NO OTHER COCKPIT INDICATION.
DUAL CHAN A/L TEST PROCEDURES & TEST EQUIP REQUIRED (22-14-31, 201)
Reset DANA (22-14-31, Fig. 103)
● Engage GO AROUND mode with AP A in CMD.
● Engage GO AROUND mode with AP B in CMD.
● Did DANA light come on?
YES
Go to 22-12-37, Fault 11
NO
NOTE
Because airspeed is less than 90 knots during ground check, the DANA light will come on at time fault is detected during A/L check
Perform DUAL chan A/L chk (22-14-31, 201) to determine what mode the DANA occured in: (ALIGN, or FLARE, or ROLLOUT, or TOUCHDOWN). Continue procedure at mode which DANA occured.
DANA at ALIGN, or FLARE, or ROLLOUT?
YES
Chk for fault in roll cmptr -1 (-2) or in yaw cmptr -1 (-2) by substituting cmptr (one at a time) with one known to be good, and then performing DUAL then A/L chk
DANA cleared by cmptr
Replace faulty roll cmptr -1 (-2) (22-13-01) or yaw cmptr -1 (-2) (22-15-01)
NO
DANA remains
DANA at ALIGN?
YES
Chk ckt #1
A/C wiring fault
Repair wiring
NO
DANA at FLARE?
YES
Did one FLARE ann. go blank and then indicate FLARE approx 5 ft lower than flare alt?
YES
(One chan not rate limited)
Replace pitch cmptr -1 (-2) on side that went blank (22-11-01)
NO
Chk ckt #2
A/C wiring fault
(Decrab memory from yaw cmptr)
Repair wiring
NO
DANA at ROLLOUT
Chk ckt #3
A/C wiring fault
Repair wiring
DANA at TOUCHDOWN
Substitute pitch cmptr -1 (-2) (one at a time) with one known to be good, and then perform DUAL chan A/L chk
(1/2 of 1 pitch cmptr not nose down)
Replace faulty pitch cmptr -1 (-2) (22-11-01)
M1-0002-22-934

A/L Touchdown to Ramp Faults
Figure 111 (Sheet 3)

EFFECTIVITY: ALL

0018



M1-0001-22-908

R A/L Touchdown to Ramp Faults
R Figure 111 (Sheet 4)

R EFFECTIVITY: ALL
R
0018

96 DANA LIGHT ON WITH BOTH AP TURNED OFF. DANA WILL NOT RESET.

Remove roll cmptr -1. Did DANA light go out? — YES → Replace roll cmptr -1. (22-13-01).

NO

Remove roll cmptr -2. Did DANA light go out? — YES → Replace roll cmptr -2. (22-13-01).

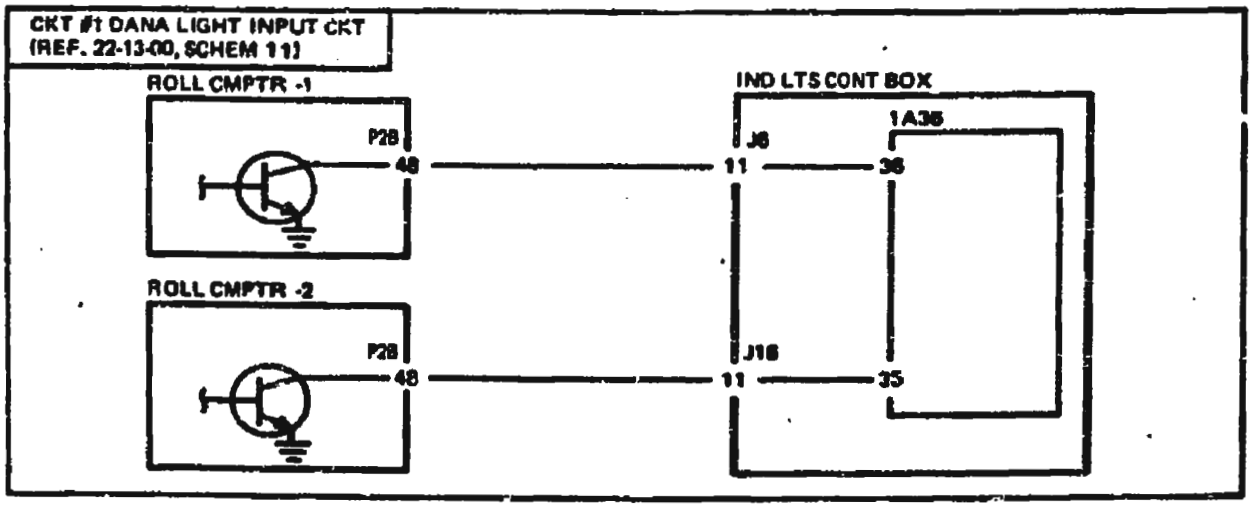
NO

- Substitute 1A36 card in ILCB (33-17-04) with one known to be good
- Did DANA light go out?

YES → Replace original 1A36 card (33-17-04)

NO

Chk ckt #1 — A/C :wiring has short to gnd → Repair wiring



M1-0001-22-837

R

AUTOLAND MODE - MAINTENANCE PRACTICES

1. General

R The AUTOLAND mode consists of a set up procedure, a single channel A/L check, a dual channel A/L check, and a completion procedure. The checks can be performed separately by first performing the set up, then the desired check, and completion. Warning annunciations and/or fail lights that appear in addition to those specifically called out in these procedures indicate an AUTOLAND fault. When AP, FD or YAW SAS faults are observed prior to A/L engagement refer to 22-INDEX for fault isolation procedure. When AUTOLAND faults are detected, refer to original fault isolation procedure or to 22-14-31, page block 101.

The purpose of the check is to identify an AUTOLAND fault by symptom and by side. This check requires that all autoflight system components and associated equipment are installed and operational. Also, performing concurrent tests on other aircraft systems should be avoided, since they may interfere with the performance of these tests.

Table 202 is an outline of the AUTOLAND check contained in Table 201.

2. Equipment and Materials

RAT Ground Safety Lock (Ref. 29-21-00)

Radio Altimeter Test Set, Collins Radio 980N-1 with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable Assembly

NOTE: To preclude possible radio altimeter mutual interference problems, use of the 980N-1 Dual Adapter (active) cable, with the radio altimeter test set is recommended.

If the 980N-1 (passive) Adapter Cable is used for autoland testing, temporary shielding of the radio altimeter antennas may be required for successful completion of the test.

CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED FOR SHIELDING MUST BE SUCH THAT REMOVAL BEFORE FLIGHT IS GUARANTEED.

VOR/ILS Ramp Test Set T-30, or equivalent

3. Referenced Procedures

	21-00-00	Air Conditioning System - Maintenance Practices
	24-00-00	Electrical Power - Maintenance Practices
	27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices
	29-21-00	Ram Air Turbine - Maintenance Practices
	32-63-00	Air/Ground Sensing System - Maintenance Practices
	34-14-00	Central Air Data Computer System - Maintenance Practices
	34-21-00	Attitude Reference System - Maintenance Practices
	34-32-00	Radio Altimeter System - Maintenance Practices
	34-33-00	Instrument Landing System - Maintenance Practices
	34-43-00	Inertial Navigation System - Maintenance Practices
R	34-55-00	VOR System - Maintenance Practices

4. AUTOLAND Check

A. General

NOTE: CONTROL SURFACE DRIFT. During ground tests with the AUTOLAND mode engaged, the airplane control surfaces may drift to full deflection although system input command signals are apparently at zero. This operation is normal, and is the result of the integration of small error signals in the system which are not compensated for by airplane response to control surface position. Over a relatively long time period (1 minute or more), differences between the integrated signals may result in a fault indication. To avoid nuisance indications of this type during the performance of an AUTOLAND test, the pace of testing should be steady and even, and long time intervals between successive steps of a test should be avoided.

AUTOLAND Check
Table 201

SET UP	ACTION	CHECK
	WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.	
1.	Turn on electrical power (Ref. 24-00-00).	
2.	.....	Avionics cooling is on (Ref. 21-00-00).
	WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM. LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED. TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT. THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.	
3.	Turn on hydraulic systems A and B (Ref. 29-11-00).	
	NOTE: The Air Turbine Motor (ATM) must be selected to the ON position. Selection of AUTO can create ground test problems.	
4.	.....	Verify that the following systems are on: Central air data computer (Ref. 34-14-00) Attitude reference (Ref. 34-21-00) Radio altimeter (Ref. 34-32-00) Instrument landing (Ref. 34-33-00)
R R R		On aircraft with INS, inertial navigation system (Ref. 34-43-00).

AUTOLAND Check (Cont)
Table 201

	SET UP	ACTION	CHECK
	5.	.....	On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed: AUTO THROT SERVO (A1) SPEED CONT (A2) (A20) YAW SAS (A3) (A23) PITCH & ROLL (A6) (A24) TRIM AGMT AC (A7) (A25) TRIM AGMT DC (A8) (A26) AFCS MODE IND (B1) (B19) FCES COMPUTERS DC (B4) FCES COMPUTERS AC&L AOA (B5) FCES STICK SHAKE (B6) SPOILER DWELL DC (B7) SPOILER DWELL AC (B8) NO. 1 AFT COUPLER (B9) NO. 2 AFT COUPLER (B27) ALT ALERT 1 (K27) ALT ALERT 2 (J21) VG/INS-1 (G6)
R			No. 1 INS PWR (E6)
R			INS HTR (E7)
R			INS/VERT GYRO (G24)
R			INS HTR (G25)
R			INS-3/GYRO-3 (E24)
R			INS-3 HTR (E25)
R		.....	On Flight Engineers/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed: FLIGHT STATION MISC R AOA (F1) STICK SHAKE (F2) AFCS WARNING CAPT (K18) F/O (K19)

AUTOLAND Check (Cont)
Table 201

SET UP	ACTION	CHECK
		On Flight Engineers/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed: IND LT PFCS ADS/DH (G8) FLT CONT ALT ALERT (G9)
6.	On CB1: open and tag MISC - RAT AUTO DEPLOY (L3) circuit breaker. On CB2: open and tag NOSE STEERING (F19) circuit breaker.	
7.	Install RAT ground safety lock (Ref. 29-21-00).	
8.	.....	All FIM annunciators are black, on all autoflight system computers.
9.	Set all throttles to idle.	
10.	Set flaps to 22 degrees and then to 33 degrees.	
11.	On FCES panel: depress STALL WARN 1 and 2 switchlights to OFF.	
12.	.....	Ensure that both HSI compass cards indicate same aircraft heading. Compass cards must agree, to within 6 degrees of each other.

AUTOLAND Check (Cont)
Table 201

SET UP	ACTION	CHECK
	NOTE: The local magnetic environment may cause disagreement between the HSI indications of more than 6 degrees. In this event both compass system must be switched to the DG mode. Under these conditions, the alignment between the compass systems must be checked prior to preforming any test which requires engagement of the AUTOLAND mode. A difference, between systems, of more than 6 degrees will cause a display of the NO ALIGN message on the AFCS WARNING indicators.	
13.	On NAV MODE panel: set both COURSE knobs to aircraft heading.	
14.	On HEADING/PITCH MODE panel: set HEADING knob to aircraft heading.	
15.	Set both VHF NAV frequency selectors to 108.1 MHz.	
16.	Position VOR/ILS ramp test set T-30 in cockpit and turn on LOC and GS POWER switches. Set LOC and GS selectors to VARIABLE and establish zero LOC and GS beam deviation on both HSI.	
17.	On ramp test set, set LOC and GS POWER switches to OFF. (Turn on LOC and GS POWER switches as required during test to preserve batteries.	

AUTOLAND Check (Cont)
Table 201

SET UP	ACTION	CHECK
18.	.....	On PFCS Monitor panel: ensure the RUDDER switch and L INBD AILERON switches are set to on, and that all STABILIZER switches are on.
19.	.....	On APFDS ENGAGE panel: ensure that AP engage and FD switches are set to OFF.
20.	On pilots overhead circuit breaker panel CB1: open RADIO ALTM (D4) and (D22) circuit breakers.	
21.	On radio altimeter test set 980N-1: set TEST SELECT switch to OFF.	
22.	In mid electrical service center: connect radio altimeter test set with dual radio cable assembly (G/ITEL No. 34-32-01) to TEST connectors on front of radio altimeter RT No. 1 and 2.	
23.	On CB1: close circuit breakers D4 and D22.	
24.	.....	On both Rad. Alt. Indicators: with Captains radio height set to zero feet, verify flags are not displayed and altitude indications agree to within 6 feet.

AUTOLAND Check (Cont)
Table 201

SET UP	ACTION	CHECK
25.	.....	On Caution and Warning Panel: verify VERTICAL GYRO 3 and DUAL A/L NOT AVAIL legends are not displayed.
26.	.....	On INSTR COMPARATOR indicator: verify cautionary messages not displayed.
27.	.....	On both ADI: verify FD and ATT flags are not displayed, and flight director command bars are not in view.
28.	.....	On Capt and F/O ADI: verify artificial horizon positions agree, within 2.5 degrees, in pitch and roll.
29.	On Capt INSTR SOURCE SELECT panel: depress ATT switchlight to ALTN.	Verify Capt and F/O ADI horizon positions agree within 2.5 degrees.
30.	Depress Capt ATT switchlight to off (dark).	
31.	Using test set: establish a simulated altitude of 2000 ft. as indicated on the instrument panel radio altitude indicators.	
32.	On FCES panel: depress YAW SAS 1 and 2 switchlights to OFF, and depress PITCH TRIM 1 and 2 switchlights to OFF.	

AUTOLAND Check (Cont)
Table 201

SET UP	ACTION	CHECK
33.	On center console: set manual PITCH TRIM WHEEL to an index of approximately 5.5 (this position and the corresponding control column position will be called neutral position for this test).	
34.	On center console: turn manual ROLL TRIM WHEEL to an index of 0.	
35.	On FCES panel: depress PITCH TRIM 1 and 2 and YAW SAS 1 and 2 switchlights to on (dark).	
36.	On APFDS ENGAGE panel: set both FD switches to ON.	On both ADI: FD flags are out-of-view, and command bars are centered and level.
37.	On CB1: open then close both PITCH & ROLL (A6 and A24) circuit breakers.	

CAUTION: ENSURE THAT ALL OBSTRUCTIONS ARE CLEAR OF THE AIRCRAFT.

NOTE: During the following tests, the rudder should not be allowed to reach the limits of its travel, either due to drift or prolonged application of a command signal. This condition can cause an unbalance between the computation circuits, resulting in a nuisance DANA annunciation.

To reset a DANA which appears below 1500 ft., the flight directors should be turned off prior to recycling circuit breakers A6 and A24. Failure to take this action will cause the DANA to set in the yaw channel.

AUTOLAND Check
Table 201

TEST	ACTION	CHECK
	DUAL CHANNEL A/L CHECK	
1.	Switch on ILS Test Set and adjust 'localizer' and glideslope controls to establish zero deviation on HSI.	
2.	On APFDS ENGAGE Panel: set AP A switch to CMD.	On Caution and Warning Panel (CAWP): DANA legend is not illuminated.
3.	On NAV MODE Select panel: depress A/L switchlight to turn on A/L light.	DANA legend is not illuminated. On both AFCS MODES annunciators: LOC ARM, GS ARM and A/L ARM messages are displayed.
4.	On the APFDS ENGAGE panel: set AP B switch to CMD.	DANA legend is not illuminated. On AFCS MODES annunciators: LOC and GS messages are displayed. ADI approach gates come in-view at GS capture.
5.	On ILS Test Set: slowly vary the localizer signal from zero to +1 dot to -1 dot and back to zero, over a period of between 10 to 15 seconds.	DANA legend is not illuminated. ADI approach gates and control wheels follow.

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
6.	On iLS Test Set: slowly vary the glideslope signal from zero to +1 dot to -1 dot and back to zero, over a period of 20 seconds.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. ADI approach gate and control column follow.
7.	On Test Set: reduce radio altitude to 1000 ft.	After approximately 35 seconds: On CAWP: DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. On AFCS MODES annunciators: A/L, ALN ARM and FLR ARM messages are displayed.
8.	On ILS Test Set: slowly vary the localizer signal from zero to +1 bar width to -1 bar width and back to zero, over a period of between 10 to 15 seconds.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. ADI approach gates, control wheels and rudder pedals follow.

NOTE: One-bar width equals left side of bar aligned with right side of pointer.

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
9.	On ILS Test Set: slowly vary the glideslope signal from zero to +1 dot to -1 dot and back to zero, over a period of 20 seconds.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. ADI approach gates and control columns follow.
10.	On Test Set: reduce radio altitude height to 170 ft.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed.
11.	On ILS Test Set: slowly vary the localizer signal from zero to +1 bar width to -1 bar width and back to zero, over a period of between 10 to 15 seconds.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. ADI approach gates, control wheels and rudder pedals follow.
12.	On ILS Test Set: slowly vary the glideslope signal from zero to +1 dot to -1 dot and back to zero, over a period of 20 seconds.	DANA legend is not illuminated. On AFCS WARNING indicators: NO DUAL messages are not displayed. ADI approach gate and control column follow.

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
13.	On Test Set: reduce radio altitude height to 130 ft.	DANA legend is not illuminated.
		On AFCS WARNING indicators: NO DUAL messages are not displayed.
		On AFCS MODES annunciators: ALIGN messages are displayed at 150 ft.
14.	On ILS Test Set: vary localizer signal from zero to +1 bar width, to -1 bar width, to zero within a 10 to 15 sec. period. Complete 2-cycles.	Monitor rudder position to ensure that it does not reach its limit.
		DANA legend is not illuminated.
		ADI approach gates, control wheels and rudder pedals follow.
15.	On ILS Test Set: vary glideslope signal from zero to +1/2 dot, to -1/2 dot, to zero over a 15 sec. period.	DANA legend is not illuminated.
		ADI approach gates and control columns follow.
16.	Simulate 'airborne' condition by either removing the AFCS/MLG ACCESSORY UNIT or by opening circuit breaker L8 or F16 on panel CB2.	

NOTE: It is not necessary to monitor pitch trim wheel rotation.

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
17.	On Test Set: reduce radio altitude height to zero, over a 10 sec. period.	Control column moves aft. DANA legend is not illuminated. On AFCS MODES annunciators: FLARE messages are displayed at 50 ft. and ROLLOUT messages are displayed at 5 ft. ADI approach gates and ADI CMD bars go out-of-view, and ADI yaw steering pointers come in-view at 5 ft.
	NOTE: Do not decrease height below zero feet as this can cause a fail on the test set.	
18.	Revert to "on ground" condition by reversing ACTION taken in TEST 16.	Control column moves forward. DANA legend is not illuminated.
19.	On CB2: close NOSE STEERING (F19) circuit breaker.	
20.	On ILS Test Set: slowly vary the localizer signal from zero to +1 bar width to -1 bar width and back to zero, over a period of between 10 to 15 seconds.	DANA legend is not illuminated. ADI yaw steering pointers, rudder pedals and nose wheel follow.
21.	On CB2: open and tag NOSE STEERING (F19) circuit breaker.	

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
22.	On ILS Test Set: slowly vary the glideslope signal from zero to +1/2 dot to -1/2 dot and back to zero over a period of 20 seconds.	DANA legend is not illuminated. No control column movement.
23.	Disconnect AP and set both FD to OFF.	

AUTOLAND Check
Table 201

TEST	ACTION	CHECK
	SINGLE CHANNEL A/L CHECK	
	NOTE: This check is used to determine which autopilot, A or B is faulted. It is accomplished by opening the circuit breakers for one autopilot and operating the other. The DANA and NO DUAL messages will be on during this test. Major FAULT symptoms to be detected are: • NO ALIGN message at A/L. • AP A (B) bat handle drops to OFF. • YAW SAS 1 (2) FAIL.	
1.	Open CB on opposite AP to be checked: • AP A-open CB1-A23, CB1-A24. R • AP B-open CB1-A5, CB1-A6.	
2.	Ensure that radio altitude is 2000 ft.	
3.	Switch on ILS Test Set and adjust 'localizer' and glideslope controls to establish zero deviation on HSI.	
	NOTE: For single channel operation of autopilot B, use data in parentheses ( ).	
4.	On APFDS ENGAGE Panel: set FD switch A (B) to ON.	Capt (F/O) ADI CMD bar is in-view and FD flag is out-of-view.
5.	On APFDS ENGAGE Panel: set AP A (B) switch to CMD.	On Caution and Warning Panel (CAWP): DANA legend is illuminated.

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
6.	On NAV MODE Select panel: depress A/L switchlight to turn on A/L light.	On both AFCS MODES annunciators: LOC ARM, GS ARM and A/L ARM messages are displayed, then LOC ARM and GS ARM messages change to LOC and GS. Capt (F/O) ADI approach gate comes in-view at LOC capture.
7.	On ILS Test Set: slowly vary the localizer signal from zero to +1 dot to -1 dot and back to zero, over a period of between 10 to 15 seconds.	Capt (F/O) approach gate and control wheels follow.
8.	On ILS Test Set: slowly vary the glideslope signal from zero to +1 dot to -1 dot and back to zero, over a period of 20 seconds.	Capt (F/O) ADI approach gate and control column follow.
9.	On Test Set: reduce radio altitude to 1000 ft.	After approximately 35 seconds: On AFCS WARNING indicators: NO DUAL messages are displayed. On AFCS MODES annunciators: A/L, ALN ARM and FLR ARM messages are displayed.
10.	On ILS Test Set: slowly vary the localizer signal from zero to +1 bar width to -1 bar width and back to zero, over a period of between 10 to 15 seconds.	Capt (F/O) ADI approach gate, control wheels and rudder pedals follow.

NOTE: One-bar width equals left side of bar aligned with right side of pointer.

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
11.	On ILS Test Set: slowly vary the glideslope signal from zero to +1 dot to -1 dot and back to zero, over a period of 20 seconds.	Capt (F/O) ADI approach gate and control columns follow.
12.	On Test Set: reduce radio altitude height to 170 ft.	
13.	On ILS Test Set: slowly vary the localizer signal from zero to +1 bar width to -1 bar width and back to zero, over a period of between 10 to 15 seconds.	Capt (F/O) approach gate, control wheels and rudder pedals follow.
14.	On ILS Test Set: slowly vary the glideslope signal from zero to +1 dot to -1 dot and back to zero, over a period of 20 seconds.	Capt (F/O) ADI approach gate and control columns follow.
15.	On Test Set: reduce radio altitude height to 130 ft.	On AFCS MODES annunciators: ALIGN messages are displayed at 150 ft.
16.	On ILS Test Set: vary localizer signal from zero to +1 bar width, to -1 bar width, to zero within a 10 to 15 sec. period. Complete 2-cycles.	Monitor rudder position to ensure that it does not reach its limit.
		Capt (F/O) ADI approach gate, control wheels and rudder pedals follow.
17.	On ILS Test Set: vary glideslope signal from zero to +1/2 dot, to -1/2 dot, to zero over a 15 sec. period.	Capt (F/O) ADI approach gate and control columns follow.

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
18.	Simulate 'airborne' condition by either removing the AFCS/MLG ACCESSORY UNIT or by opening circuit breaker L8 or F16 on panel CB2.	
	NOTE: It is not necessary to monitor pitch trim wheel rotation.	
19.	On Test Set: reduce radio altitude height to zero, over a 10 sec. period.	On AFCS MODES annunciators: FLARE messages are displayed at 50 ft., and ROLLOUT messages are displayed at 5 ft.
		Control column moves aft.
		Capt (F/O) ADI approach gate and CMD bar go out-of-view, and yaw steering pointer comes in-view at 5 ft.
	NOTE: Do not decrease height below zero feet as this can cause a fail on the test set.	
20.	Revert to "on ground" condition by reversing ACTION taken in TEST 18.	Control column moves forward.
21.	On CB2: close NOSE STEERING (F19) circuit breaker	
22.	On ILS Test Set: slowly vary the localizer signal from zero to +1 bar width to -1 bar width and back to zero, over a period of between 10 to 15 seconds.	Capt (F/O) ADI yaw steering pointer, rudder pedal and nose wheel follow.
23.	On CB2: open and tag NOSE STEERING (F19) circuit breaker.	

AUTOLAND Check (Cont)
Table 201

TEST	ACTION	CHECK
24.	On ILS Test Set: slowly very the glideslope signal from zero to +1/2 dot to -1/2 dot and back to zero over a period of 20 seconds.	No control column movement.
25.	Disconnect AP A(B) and set FD A(B) to OFF.	DANA legend remains on.
26.	Close circuit breakers CB1-A23, CB1-A24 or CB1-A5, CB1-A6 opened in Step 1.	
27.	Cycle both YAW SAS switchlights to OFF then on.	
28.	On CB1, open then close PITCH AND ROLL (A6) and (A24) circuit breakers.	DANA legend is extinguished.

AUTOLAND Check
Table 201

TEST	ACTION	CHECK
	COMPLETION	
1.	Raise flaps to 0 degrees.	
2.	Move trim wheel fully nose down.	
3.	Disconnect test setup.	
4.	Ensure radio altimeter fail flags are clear.	
5.	On CB1: remove tag and close MISC-RAT AUTO DEPLOY (L3) circuit breaker.	
6.	Remove RAT ground safety lock (Ref. 29-21-00).	
7.	Turn off hydraulic power (Ref. 29-11-00).	
8.	Turn off electrical power (Ref. 24-00-00).	
9.	Reset FIM on radio altimeter RT's if tripped.	
10.	Ensure AFCS/MLG ACCESSORY UNIT is fitted.	
11.	Ensure circuit breakers are closed.	

R AUTOLAND Check Outline
R Table 202

SET UP FOR AUTOLAND CHECK "OUTLINE" (See Table 201 for details)
1. Electr pwr on.
2. Avionics cooling on.
3. Hydro A & B on.
4. Associated sys on.
5. Applicable CB closed.
6. CB1, open F19 & L3.
7. RAT gnd safety lock installed.
8. Chk FIM on AFCS units.
9. Throttles to IDLE.
10. Flaps to 22 deg. then >30 deg.
11. STALL WARN to OFF.
12. Compass sys agree.
13. COURSE knobs to acft HDG.
14. HEADING Knobs to acft HDG.
15. VHF Nav pnl to 108.1 mHz.
16. Set up ILS test set.
17. -
18. RUDDER, L INBD AILERON, & all STABILIZER sw to on.
19. AP & FD to OFF.
20. Set up Radio Alt Test Set.
21. -
22. -
23. -
24. -
25. VG-3 & DANA lights out.
26. INSTR COMPARATOR messages OK.
27. FD & ATT flags and CMD bars out of view.
28. Both ADI agree in pitch and roll.
29. -
30. -
31. Radio alt to 2000 ft.
32. YAW SAS & PITCH TRIM to OFF.
33. PITCH TRIM WHEEL index to 5.5.
34. ROLL TRIM WHEEL index to 0.
35. YAW SAS & PITCH TRIM to on.
36. Both FD to ON. CMD bars in view.
37. Cycle CB1-A6 and -A24 CB.

R AUTOLAND Check Outline
R Table 202

DUAL CHANNEL AUTOLAND CHECK "OUTLINE" (See Table 201 for details)

TEST	ACTION	CHECK
1.	ILS test set: zero LOC and GS	-
2.	AP A to CMD.	- DANA not on.
3.	Depress A/L.	- LOC ARM, GS ARM, A/L ARM.
4.	AP B to CMD.	- LOC ARM and GS ARM to LOC and GS. APRCH gate at GS.
5.	LOC sweep (1 dot on HSI)	- APRCH gate and cont whl follows.
6.	GS sweep (1 dot on HSI).	- APRCH gate and cont Col follows.
7.	Radio alt. to 1000 ft.	- A/L, ALN ARM, FLR ARM at 1500 ft.
8.	LOC sweep (1 bar-width on HSI).	- APRCH gate, cont whl and rud pedals follow.
9.	GS sweep (1 dot on HSI).	- APRCH gate and control col follow.
10.	Radio alt. to 170 ft.	-
11.	Repeat Step 8.	-
12.	Repeat Step 9.	-
13.	Radio alt. to 130 ft.	ALIGN at 150 ft.
14.	Repeat Step 8.	-
15.	GS sweep (1/2 dot on HSI).	- APRCH gate and cont col follow.
16.	Simulate acft airborne.	-
17.	Radio alt. to 0 ft. in 10 sec.	-FLARE at 50 ft. and ROLLOUT at 5 ft. Cont col moves aft. Yaw steering ptr in view, and APRCH gate & cmd bars out of view at 5 ft.
18.	Reverse Step 16 (on-ground).	-Cont col moves fwd.
19.	On CB2, close F19 CB.	-
20.	LOC sweep (1 bar-width on HSI).	- Yaw steering ptr, rud pedal and nose whl follow.
21.	On CB2, open F19 CB.	-
22.	GS sweep (1/2 dot on HSI).	- No cont col movement.
23.	Disc AP and set both FD to OFF.	-

R AUTOLAND Check Outline
R Table 202

SINGLE CHANNEL AUTOLAND CHECK "OUTLINE" (See Table 201 for details)

TEST	ACTION	CHECK
1.	Open CB on opposite AP: • AP A - open CB1-A23, -24. • AP B - open CB1-A5, -A6.	-
2.	Radio alt 2000 ft.	-
3.	ILS test set: zero LOC and GS ind on HSI.	-
4.	FD A (B) to ON.	- Capt (F/O) CMD bar in view. FD flag out of view.
5.	AP A (B) to CMD.	- DANA light on.
6.	Depress A/L.	- LOC ARM, GS ARM, A/L ARM. LOC ARM and GS ARM to LOC and GS. APRCH gate at GS.
7.	LOC sweep (1 dot on HSI)	- APRCH gate and cont whl follow.
8.	GS sweep (1 dot on HSI).	- APRCH gate and cont col follows.
9.	Radio alt. to 1000 ft.	- A/L, ALN ARM, FLR ARM and NO DUAL at 1500 ft.
10.	LOC sweep (1 bar-width on HSI).	- APRCH gate, cont whl and rud pedals follow.
11.	GS sweep (1 dot on HSI).	APRCH gate and cont col follow.
12.	Radio alt. to 170 ft.	-
13.	Repeat Step 10.	-
14.	Repeat Step 11.	-
15.	Radio alt. to 130 ft.	- ALIGN at 150 ft.
16.	Repeat Step 10.	-
17.	GS sweep (1/2 dot on HSI).	- APRCH gate and cont col follow.
18.	Simulate acft airborne.	-
19.	Radio alt. to 0 ft. in 10 sec.	- FLARE at 50 ft. and ROLLOUT at 5 ft. Cont col moves aft. Yaw steering ptr in view, and APRCH gate & cmd bars out of view at 5 ft.
20.	Reverse Step 18 (on-ground).	-Contcol moves fwd.
21.	On CB2, close F19 CB.	-
22.	LOC sweep (1 bar-width on HSI).	- Yaw steering ptr, rud pedal and nose whl follow.
23.	On CB2, open F19 CB.	-
24.	GS sweep (1/2 dot on HSI).	- No cont col movement.
25.	Disc AP and set FD to OFF.	- DANA light remains on.
26.	Close CB opened in Step 1.	-

AUTOLAND Check Outline (Cont)
Table 202

SINGLE CHANNEL AUTOLAND CHECK "OUTLINE" (See Table 201 for details)

TEST	ACTION	CHECK
27.	Cycle Yaw SAS OFF, then on.	-
28.	On CB1, open then close A6 and A24 CB.	- DANA light out

R AUTOLAND MODE (TOTAL SEQUENCE) - ADJUSTMENT AND TEST

R 1. General

R The fault detection test procedure in Paragraph 4 is used in
R conjunction with the fault isolation procedure in Paragraph 5.
R When a malfunction is confirmed by the test, refer to the fault
R number in Paragraph 5 for appropriate fault isolation.

R 2. Equipment and Materials

R VOR/ILS Ramp Test Set T-30, or equivalent

R 3. Referenced Procedures

R 22-12-00 APFDS Modes of Operation - Maintenance Practice

R 22-02-01 AFCS Lamps and Annunciators - Fault Isolation

R 22-10-31 FD Basic Mode - Fault Isolation

R 22-13-31 FD Heading Select Mode - Fault Isolation

R 22-10-33 Autopilot A CWS/CMD Mode - Fault Isolation

R 22-10-35 Autopilot B CWS/CMD Mode - Fault Isolation

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Turn on APFDS as described in 22-12-00.

R B. AUTOLAND Mode (Total Sequence) Test

R (1) Check indications on both radio altimeter indicators
R (RAI).

R RESULT:

R Flags are out of view.

R Altitude agrees within 6 feet at nominal altitude
R of zero feet.

R (2) Check indications on caution and warning panel (CAWP).

R RESULT:

R VERTICAL GYRO 3 legend off.

R DUAL A/L NOT AVAIL (DANA) legend off.

R (3) Check messages on INSTR COMPARATOR.

R RESULT:

R ATTITUDE messages are not displayed.

R (4) Check indications on both ADIs.

R RESULT:

R FD and ATT flags are out of view.

R Command bars out of view.

R (5) On Capt standby horizon indicator, check that flag is
R not displayed.

R (6) Check artifical horizon positions on Capt ADI and
R standby horizon indicator.

R RESULT:

R Indications agree within 2.5 degrees in pitch and
R roll.

R (7) Check artifical horizon position on F/O ADI and standby
R horizon indicator.

R RESULT:

R Indications agree within 2.5 degrees in pitch and
R roll.

R (8) Check artifical horizontal position on both ADIs.

R RESULT:

R Indications agree within 2.5 degrees in pitch and
R roll.

R (9) Set AP engage switch A to CWS.

R RESULT:

R Control column and wheel positions do not change.

R On AFCS WARNING indicators, AP LIMIT messages are
R not displayed.

R On CAWP, DANA message is not displayed.

R (10) Set AP engage switch A to OFF.

R RESULT:

R On both AFCS WARNING indicators, AP DISC messages
R and flashing ALERT lights are displayed.

R Aural warning sounds for approximately 2 seconds.

R (11) Set AP engage switch B to CWS.

R RESULT:

R Control column and wheel positions do not change.

R On both AFCS WARNING indicators, AP DISC messages
R and flashing ALERT lights are removed, and AP
R LIMIT messages are not displayed.

R (12) Set FD engage switches A and B to ON.

R RESULT:

R Both ADI FD are out of view.

R Both ADI command bars come into view and are
R centered.

R (13) On ILS test set, turn on LOC POWER and GS POWER
R switches.

R (14) Using ILS test set, adjust LOC for a 1-dot steer-left
R indication on Capt HSI.

R RESULT:

R On both HSIs, NAV flags are not displayed and LOC
R deviation indications agree to within 1-bar width.

R On both ADIs, localizer shutters are not displayed
R and LOC deviation indications agree to within 1/4
R inch.

R On CAWP, DANA message is not displayed.

R (15) Using ILS test set, adjust GS for a 1-dot steer-up
R indication on Capt HSI.

R RESULT:

R On both HSIs, GS flags are not displayed and GS
R deviation indications agree to within 1-needle
R width.

R On both ADIs, GS flags are not displayed and
R glideslope indications agree to within 1-needle
R width.

R On CAWP, DANA message is not displayed.

R (16) On NAV MODE panel, depress A/L switchlight to on.

R RESULT:

R On both AFCS MODES annunciators, LOC ARM and GS
R ARM messages are displayed.

R On both AFCS WARNING indicators, NO FLARE messages
R and flashing ALERT lights are displayed.

R (17) Using ILS test set, adjust LOC for zero deviation
R indication on Capt HSI.

R RESULT:

R On both AFCS MODES annunciators, LOC ARM messages
R are replaced by LOC messages within 10 seconds.

R On both ADIs, command bars are centered and level
R (ignore any temporary roll commands).

R (18) On NAV MODE panel, rotate Capt COURSE knob clockwise 40
R degrees from aircraft heading.

R RESULT:

R NO ALIGN message is displayed at approximately 9
R degrees CW.

R On Capt ADI, command bar commands right roll and
R then starts to return to level within 15 seconds.

R On CAWP, DANA message is not displayed.

R (19) Set Capt COURSE knob to aircraft heading.

R RESULT:

R NO ALIGN message is removed at approximately 5
R degrees CCW.

R (20) On NAV MODE panel, rotate F/O COURSE knob clockwise 40
R degrees from aircraft heading.

R RESULT:

R NO ALIGN message is displayed at approximately 9
R degrees CW.

R On F/O ADI, command bar commands right roll and
R then starts to return to level within 15 seconds
R after 40 degrees is reached.

R On CAWP, DANA message is not displayed.

R (21) Set F/O COURSE knob to aircraft heading.

R RESULT:

R NO ALIGN message is removed at approximately 5
R degrees CCW.

R (22) Using ILS test set, adjust LOC for 1-dot steer-left
R indication on Capt HSI.

R RESULT:

R On both ADIs, command bars command left-roll
R within 15 seconds.

R (23) Using ILS test set, adjust LOC for a zero deviation
R indication on Capt HSI.

R RESULT:

R Wait until both ADI command bars are approximately
R level before proceeding with test.

R (24) Using ILS test set, adjust GS for zero deviation
R indication on Capt HSI.

R RESULT:

R On both AFCS MODES annunciators, GS ARM messages
R are replaced by GS messages within 10 seconds.

R On both ADIs, command bars are taken out of view
R within 45 seconds, and FD flags are out of view.

R NO ALIGN message is displayed within 45 seconds.

R On CAWP, DANA message is not displayed.

R (25) Set AP engage switch B to CMD.

R RESULT:

R On center console, pitch trim wheels do not
R rotate.

R Control columns move forward and stop.

R On both AFCS MODES annunciators, A/L, ALIGN,
R FLARE, and ROLLOUT messages are displayed.

R On both AFCS WARNING indicators, NO ALIGN and NO
R FLARE messages are removed.

R NO DUAL messages are displayed.

R AP LIMIT messages are not displayed.

R On FCES panel, YAW SAS 1 and 2, and PITCH TRIM 1
R and 2 switchlights do not indicate FAIL.

R On CAWP, DANA message is not displayed.

R (26) Set AP engage switch A to CMD.

R RESULT:

R On both AFCS WARNING indicators, NO DUAL messages
R and flashing ALERT lights are removed.

R On CAWP, DANA message is not displayed.

R (27) In FESC, remove AFCS/MLG Accessory Unit (Ref.
R 22-10-11).

R RESULT:

R On center console, pitch trim wheels rotate for
R nose-down trim.

R Control columns move forward.

R On FCES panel, PITCH TRIM 1 and 2 switchlights do
R not indicate FAIL.

R (28) On ramp test set, adjust GS for a 2-dot steer-up
R indication on Capt HSI.

R RESULT:

R Control columns do not move.

R On CAWP, DANA message is not displayed.

R (29) Prepare to take the following steps in approximately 5 seconds: Using ILS test set, rapidly adjust LOC to approximately 1/2-dot steer-right indication on Capt HSI. Hold for approximately 2 seconds. Control wheels may rotate slightly. AP engage switches A and B remain at CMD. Rapidly adjust LOC for zero deviation indication.

R RESULT:

R On FCES panel, YAW SAS 1 and 2 switchlights do not indicate FAIL. AP engage switches remain at CMD.
R On CAWP, DANA message is not displayed.

R (30) Set FD engage switches A and B to OFF.

R (31) On Capt control wheel, depress AP DISC switch.

R RESULT:

R AP engage switches A and B drop to OFF.

R Aural warning sounds.

R On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed.

R On both AFCS MODES annunciators, all messages are removed.

5. Fault Isolation

A. General

Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 502. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

AUTOLAND Mode (Total Sequence) Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
4B(1)-1	Flag is displayed on RAI	(1)
4B(1)-2	RAI altitude indications do not agree within 6 feet	(2)
4B(2)-1	VERTICAL Gyro 3 message on CAWP	
4B(2)-2	DANA message on CAWP	(4)
4B(3)	ATTITUDE message on INSTR COMPARATOR	(5)
4B(4)-1	ADI FD flag or command bar in view	(6)
4B(4)-2	ADI ATT flag in view	(7)
4B(5)	Capt standby horizon indicator flag	(8)
4B(6)	Horizon positions on Capt ADI do not agree with standby horizon indicator	(9)
4B(7)	Horizon positions on F/O ADI do not agree with standby horizon indicator	(10)
4B(8)	Horizon positions on Capt and F/O ADI disagree	(11)
4B(9)-1	AP engage switch A cannot be raised to CWS	(12)
4B(9)-2	AP engage switch A will not hold in CWS	(13)

R AUTOLAND Mode (Total Sequence) Fault Isolation Summary (Cont)
R Table 501

TEST REF.	FAULT	FAULT NO.
4B(9)-3	AP LIMIT message	(14)
4B(9)-4	Control column position changes	(15)
4B(9)-5	Control wheel position changes	(16)
4B(9)-6	DANA message on CAWP	(17)
4B(10)-1	AP DISC or ALERT not displayed	(18)
4B(10)-2	Aural warning does not sound or will not stop	(19)
4B(11)-1	AP engage switch B cannot be raised to CWS	(20)
4B(11)-2	AP engage switch B will not hold in CWS	(21)
4B(11)-3	AP LIMIT message	(22)
4B(11)-4	Control column position changes	(23)
4B(11)-5	Control wheel position changes	(24)
4B(12)	ADI fault indication	(25)
4B(14)-1	ADI indications incorrect or do not agree	(26)
4B(14)-2	HSI indications incorrect or do not agree	(27)
4B(14)-3	DANA message on CAWP	(28)
4B(15)-1	ADI indications incorrect or do not agree	(29)
4B(15)-2	HSI indications incorrect or do not agree	(30)
4B(15)-3	DANA message on CAWP	(31)
4B(16)-1	A/L switchlight not illuminated	(32)
4B(16)-2	No LOC ARM message on Capt annunciator	(33)

AUTOLAND Mode (Total Sequence) Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(16)-3	No GS ARM message on Capt annunciator	(34)
4B(16)-4	No LOC ARM message on F/O annunciator	(35)
4B(16)-5	No GS ARM message on F/O annunciator	(36)
4B(16)-6	NO FLARE message not displayed on Capt indicator	(37)
4B(16)-7	NO FLARE message not displayed on F/O indicator	(38)
4B(17)-1	No LOC message on Capt annunciator	(39)
4B(17)-2	No LOC message on F/O annunciator	(40)
4B(17)-3	Capt ADI FD flag	(41)
4B(17)-4	Capt ADI command bar not level	(42)
4B(17)-5	F/O ADI FD flag	(43)
4B(17)-6	F/O ADI command bar not level	(44)
4B(18)-1	Capt ADI command bar does not move	(45)
4B(18)-2	Capt ADI command bar does not level	(46)
4B(18)-3	DANA message on CAWP	(47)
4B(18)-4	NO ALIGN message not displayed on Capt indicator	(48)
4B(18)-5	NO ALIGN message not displayed on F/O indicator	(49)
4B(20)-1	F/O ADI command bar does not move	(50)
4B(20)-2	F/O ADI command bar does not level	(51)
4B(20)-3	DANA message on CAWP	(52)
4B(22)-1	Capt ADI command bar does not move	(53)
4B(22)-2	F/O ADI command bar does not move	(54)

AUTOLAND Mode (Total Sequence) Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(24)-1	No GS message on Capt annunciator	(55)
4B(24)-2	No GS message on F/O annunciator	(56)
4B(24)-3	Capt ADI command bar not taken out of view	(57)
4B(24)-4	F/O ADI command bar not taken out of view	(58)
4B(24)-5	DANA message on CAWP	(59)
4B(25)-1	AP engage switch B cannot be set to CMD	(60)
4B(25)-2	Pitch trim wheels rotate	(61)
4B(25)-3	A/L or FLARE messages not displayed on Capt annunciator	(62)
4B(25)-4	A/L or FLARE messages not displayed on F/O annunciator	(63)
4B(25)-5	ALIGN or ROLLOUT messages not displayed on Capt annunciator	(64)
4B(25)-6	ALIGN or ROLLOUT message not displayed on F/O annunciator	(65)
4B(25)-7	NO ALIGN message not removed on Capt or F/O indicator	(66)
4B(25)-8	NO FLARE message not removed on Capt or F/O indicator	(67)
4B(25)-9	NO DUAL message not displayed on Capt indicator	(68)
4B(25)-10	NO DUAL message not displayed on F/O indicator	(69)
4B(25)-11	AP LIMIT message on both indicators	(70)
4B(25)-12	DANA message on CAWP	(71)

AUTOLAND Mode (Total Sequence) Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
4B(26)-1	NO DUAL message is not removed on both indicators	(72)
4B(26)-2	DANA message on CAWP	(73)
4B(27)-1	Pitch trim wheels do not rotate	(74)
4B(27)-2	PITCH TRIM 1 or 2 switchlight FAIL	(75)
4B(28)-1	Control columns move	(76)
4B(29)-1	DANA message on CAWP	(77)
46(29)-2	AP engage switch A drops to OFF	(78)
4B(29)-3	AP engage switch B drops to OFF	(79)
4B(29)-4	YAW SAS 1 switchlight FAIL	(80)
4B(29)-5	YAS SAS 2 switchlight FAIL	(81)
4B(31)-1	AP engage switches do not drop to OFF	(82)
4B(31)-2	Messages not removed from annunciator	(83)

Schematics for Fault Isolation of AUTOLAND Mode Problem
Table 502

TITLE	LOCATION
Pitch Systems No. 1 and No. 2 ALTRK Mode Signal Flow Schematic	22-11-00, Schem 7
Glide Slope Capture, Track, Approach Land, and Flare Engage Logic Schematic	22-11-00, Schem 15
Roll Systems No. 1 and No. 2 AUTOLAND Mode Signal Flow Schematic	22-13-00, Schem 6
A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7

R Schematics for Fault Isolation of AUTOLAND Mode Problem (Cont)
R Table 502

TITLE	LOCATION
HDG SEL, HDG Hold, Capture, A/L TRK-B and R-NAV Mode Engage Logic Schematic	22-13-00, Schem 8
A/L TRK A, TRK 1, VOR/LOC Capture, OS and LOC TRK Mode Engage Logic Schematic	22-13-00, Schem 9

B. AUTOLAND Mode (Total Sequence) Faults

The following are general procedures to be used during the fault isolation procedure.

Engage DUAL CHANNEL AUTOLAND TRACK MODE as follows:

On ramp test set, turn on LOC POWER and GS POWER switches, and adjust LOC and GS for zero deviation on Capt HSI.

Set AP engage switch A to CMD.

Depress A/L switchlight to on, and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are temporarily displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN, FLARE and ROLLOUT messages are displayed.

NOTE: Control column and wheel motions, pitch trim wheel motion, and display of AP LIMIT messages on AFCS WARNING indicators may be ignored.

Disengage both autopilots as follows:

Set FD engage switches A and B to OFF.

Set AP engage switches A and B to OFF.

RESULT:

On both AFCS MODES annunciators, all messages are removed.

On both AFCS WARNING indicators, AP DISC messages are displayed.

(1) Fault: Flag is displayed on RAI

(a) Check for fault in corresponding radio altimeter system (Ref. 34-32-00).

---

(2) Fault: RAI altitude indications do not agree to within 6 feet.

(a) Perform radio altimeter system SELF TEST (Ref. 34-32-00).

---

(3) Fault: VERTICAL GYRO 3 message displayed on CAWP.

R (a) On aircraft without INS, check VG No. 3 for fault (Ref. 34-21-00).

R (a) On aircraft with INS, check inertial unit No. 3 for fault (Ref. 34-43-00).

---

(4) Fault: DANA message displayed on CAWP.

(a) On CB1, open NO. 1 and NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. On CAWP, is DANA message removed?

Yes: Go to Step (b).

No: Go to Step (d).

(b) Close A6 circuit breaker. Is DANA message displayed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Go to Step (c).

(c) Close A24 circuit breaker. Is DANA message displayed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Continue test at Step (3).

(d) From Step (a). Remove roll computers No. 1 and No. 2 (Ref. 22-13-01). On CAWP, is DANA message removed?

Yes: Go to Step (e).

No: Check for a fault in the indicator lights control box (Ref. 33-17-00).

(e) Install roll computer No. 1 (Ref. 22-13-01). On CAWP, is DANA message displayed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Replace roll computer No. 2 (Ref. 22-13-01).

---

(5) Fault: On INSTR COMPARATOR indicators, ATTITUDE messages are displayed.

(a) Perform ATTITUDE fault isolation procedures (Ref. 34-16-00).

---

(6) Fault: ADI FD flag displayed or command bar in view.

(a) Perform fault isolation procedure in 22-10-31 for Faults (1) through (4).

---

(7) Fault: ADI ATT flag displayed.

(a) Check vertical gyro (inertial unit) associated with ADI for fault (Ref. 34-21-00 or 34-43-00). If problem persists, replace ADI (Ref. 34-21-07).

---

(8) Fault: Flag displayed on standby horizon indicator.

(a) Replace indicator (Ref. 34-23-01).

---

(9) Fault: Horizon positions on Capt ADI and standby horizon indicator do not agree.

(a) Do Capt and F/O ADI horizon positions agree?

Yes: Replace standby horizon indicator (Ref. 34-23-01).

No: Go to Step (b).

(b) On Capt INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Do Capt and F/O ADI horizon positions agree?

Yes: Fault isolate vertical gyro (inertial unit) No. 1 (Ref. 34-21-00 or 34-43-00).

No: Replace Capt ADI (Ref. 34-21-07).

---

(10) Fault: Horizon positions on F/O ADI and standby horizon indicator do not agree.

(a) On F/O INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Do F/O and Capt ADI horizon positions agree?

Yes: Fault isolate vertical gyro (inertial unit) No. 2 (Ref. 34-21-00 or 34-43-00).

No: Replace F/O ADI (Ref. 34-21-07).

---

(11) Fault: Horizon positions on Capt and F/O ADIs do not agree.

(a) On Capt INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Do Capt and F/O ADI horizon positions agree?

Yes: Fault isolate vertical gyro (inertial unit) No. 1 (Ref. 34-21-00 or 34-43-00).

No: Go to Step (b).

(b) On F/O INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Do Capt and F/O ADI horizon positions agree?

Yes: Fault isolate vertical gyro (inertial unit) No. 2 (Ref. 34-21-00 or 34-43-00).

No: Replace Capt ADI (Ref. 34-21-07). If problem persists, replace F/O ADI (Ref. 34-21-07).

(12) Fault: AP engage switch A cannot be raised to CWS.

(a) Perform fault isolation procedure in 22-10-33 for Fault (4).

---

(13) Fault: AP engage switch A will not hold in CWS.

(a) Perform fault isolation procedure in 22-10-33 for Fault (5).

---

(14) Fault: AP LIMIT message is displayed.

(a) Perform fault isolation procedure in 22-10-33 for Fault (6).

---

(15) Fault: Control column position changes.

(a) Perform fault isolation procedure in 22-10-33 for Fault (7).

---

(16) Fault: Control wheel position changes.

(a) Perform fault isolation procedures in 22-10-33 for Fault (8).

---

(17) Fault: DANA message on CAWP.

(a) Perform the following tests:

FD Basic Mode test (Ref. 22-10-31).

Autopilot A CWS/CMD test (Ref. 22-10-33).

Autopilot B CWS/CMD test (Ref. 22-10-35).

Do any of these tests indicate a fault condition?

Yes: Perform fault isolation procedures specified for the test.

No: Go to Step (b).

(b) On Capt ADI, note pitch position of artificial horizon. On Capt INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Does pitch indication change by more than 2.5 degrees?

Yes: Go to Step (c)

No: Go to Step (d).

(c) On F/O ADI, note pitch position of artificial horizon. On F/O INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Does pitch indication change by more than 2.5 degrees?

Yes: Fault isolate vertical gyro (inertial unit) No. 3 (Ref. 34-21-00 or 34-43-00).

No: Fault isolate vertical gyro (inertial unit) No. 1 (Ref. 34-21-00 or 34-43-00).

(d) From Step (b).

On Capt ADI, note roll position of artificial horizon. On Capt INSTR SOURCE SELECT panel, depress ATT switchlight to off (dark). Does roll indication change by more than 2.5 degrees?

Yes: Go to Step (e)

No: Go to Step (f).

(e) On F/O ADI, note roll position of artificial horizon. On F/O INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Does roll indication change by more than 2.5 degrees?

Yes: Fault isolate vertical gyro (inertial unit) No. 3 (Ref. 34-21-00 or 34-43-00).

No: Fault isolate vertical gyro (inertial unit) No. 1 (Ref. 34-21-00 or 34-43-00).

(f) From Step (d). On F/O ADI, note pitch position of artificial horizon. On F/O INSTR SOURCE SELECT panel, depress ATT switchlight to ALTN. Does pitch indication change by more than 2.5 degrees?

Yes: Fault isolate vertical gyro (inertial unit) No. 1 (Ref. 34-21-00 or 34-43-00).

No: Go to Step (g).

(g) From Step (f). On F/O ADI, note roll position of artificial horizon. On F/O INSTR SOURCE SELECT panel, depress ATT switchlight to off (dark). Does roll indication change by more than 2.5 degrees?

Yes: Fault isolate vertical gyro (inertial unit) No. 2 (Ref. 34-21-00 or 34-43-00).

No: Go to Step (h).

(h) Engage dual channel AUTOLAND track mode, and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (k).

No: Go to Step (i).

(i) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (j).

No: Check for a fault in the indicator lights control box (Ref. 33-17-04).

(j) Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Fault causing DANA message display is associated with side 2 (F/O's) AFCS. Go to Step (s).

No: Fault causing DANA message display is associated with both the side 1 and side 2 AFCS (3rd sensor fault or equivalent). Go to step (aa).

(k) From Step (h). On CB1, open NO. 1 SYSTEMS - YAW SAS (A5), NO. 1 NAVIGATION - ILS (G4), NO. 2 SYSTEMS - PITCH & ROLL (A24) and YAW SAS (A23), and NO. 2 NAVIGATION - ILS (G22) circuit breakers. In FESC, identify (NO. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01), roll computers No. 1 and No. 2 (Ref. 22-13-01), yaw computers No. 1 and No. 2 (Ref. 22-15-01), and ILS receivers No. 1 and No. 2 (Ref. 34-33-01). Close A5, A6, G4, A23, A24, and G22 circuit breakers. Wait one full minute. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Fault is still associated with side 1 AFCS. Go to Step (l).

No: Fault is in (previously identified) pitch, roll, or yaw computer No. 1, or ILS receiver No. 1. Go to Step (m).

(l) On CB1, open NO. 1 SYSTEMS - TRIM AGMT - AC(A7) and YAW SAS (A5), NO. 1 NAVIGATION RADIO ALTM (D4), NO. 2 SYSTEMS - PITCH & ROLL (A24), TRIM AGMT - AC (A25) and YAW SAS (A23), and NO. 2 NAVIGATION - RADIO ALTM (D22) circuit breakers. In mid-electrical service center, identify and then interchange radio altimeter RT's No. 1 and No. 2 (Ref. 34-32-01). On galley overhead, identify and then interchange cables connected to lateral accelerometer connectors No. 1 and No. 2 (Ref. 22-13-02), and normal accelerometer connectors No. 1 and No. 2 (Ref. 22-11-02). Close A5, A6, A7, D4, A23, A24, A25, and D22 circuit breakers. Wait one minute. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Fault isolate vertical gyro (inertial unit) No. 1 (Ref. 34-21-00 or 34-43-00).

No: Fault is in (previously identified) radio altimeter RT, lateral accelerometer, or normal accelerometer No. 1. Go to Step (p).

(m) From Step (k). On CB1, open PITCH & ROLL (A24) circuit breaker. Interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of 5B.

On CB1, open PITCH & Roll (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) pitch computer No. 1 (Ref. 22-11-01).

No: Go to Step (n).

(n) On CB1, open PITCH & ROLL (A24) circuit breaker. Interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at the beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) roll computer No. 1 (Ref. 22-13-01).

No: Go to Step (o).

(o) On CB1, open YAW SAS (A5) and (A23) circuit breakers. Interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A6, A5, and A23 circuit breakers. Wait one full minute. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

No: Replace (previously identified) ILS receiver No. 1 (Ref. 34-33-01).

(p) From Step (l). On CB1, open RADIO ALTM (D4) and (D22) circuit breakers. Interchange radio altimeter RTs No. 1 and No. 2 (Ref. 34-32-01). Close A6, D4, and D22 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) radio altimeter RT No. 1 (Ref. 34-32-01). Open A5, A7, A23, A24, and A25 circuit breakers and interchange (previously identified) lateral accelerometer, and normal accelerometer No. 1 and No. 2 cables to bring system back to its original configuration.

No: Go to Step (q).

(q) On CB1, open PITCH & ROLL (A24) circuit breaker. Interchange cables to lateral accelerometer connectors No. 1 and No. 2 (Ref. 22-13-02). Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace lateral accelerometer unit (Ref. 22-13-02). Open A5, A7, A23, and A25 circuit breakers and interchange (previously identified) normal accelerometer No. 1 and No. 2 cables to bring system back to its original configuration.

No: Go to Step (r).

(r) On CB1, open TRIM AGMT - AC (A7) and (A25) circuit breakers. Interchange cables to normal accelerometer connectors No. 1 and No. 2 (Ref. 22-11-02). Close A6, A7, and A25 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace normal accelerometer unit (Ref. 22-11-02).

No: Replace trim augmentation computer (Ref. 22-18-01).

(s) From Step (j). On CB1, open No. 2 SYSTEMS - YAW SAS (A23), NO. 2 NAVIGATION - ILS (G22), NO. 2 SYSTEMS - PITCH & ROLL (A6), and YAW SAS (A5), and NO. 1 NAVIGATION - ILS (G4) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 2 and No. 1 (Ref. 22-11-01), roll computers No. 2 and No. 1 (Ref. 22-13-01), yaw computers No. 2 and No. 1 (Ref. 22-15-01), and ILS receivers No. 2 and No. 1 (Ref. 34-33-01). Close A23, A24, G22, A5, A6, and G4 circuit breakers. Wait one full minute. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Fault is still associated with side 2 AFCS. Go to Step (t).

No: Fault is in (previously identified) pitch, roll, or yaw computer No. 2, or ILS receiver No. 2. Go to Step (u).

(t) On CB1, open NO. 2 SYSTEMS - TRIM AGMT - AC (A25) and YAW SAS (A23), NO. 2 NAVIGATION - RADIO ALTM (D22), NO. 2 SYSTEMS - PITCH & ROLL (A6), TRIM AGMT - AC (A7) and YAW SAS (A5), and NO. 1 NAVIGATION - RADIO ALTM (D4) circuit breakers. In mid electrical service center, identify and then interchange radio altimeter RT's No. 2 and No. 1 (Ref. 34-32-01). On galley overhead, identify and then interchange cables connected to lateral accelerometer connectors No. 2 and No. 1 (Ref. 22-13-02), and normal accelerometer connectors No. 2 and No. 1 (Ref. 22-11-02). Close A23, A24, A25, D22, A5, A6, A7, and D4 circuit breakers. Wait one full minute. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Fault isolate vertical gyro (inertial unit) No. 2 (Ref. 34-21-00 or 34-43-00)

No: Fault is in (previously identified) radio altimeter RT, lateral-accelerometer or normal accelerometer No. 2. Go to Step (x).

(u) From Step (s). On CB1, open PITCH & ROLL (A6) circuit breaker. Interchange pitch computers No. 2 and No. 1 (Ref. 22-11-01). Close A24 and A6 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) pitch computer No. 2 (Ref. 22-11-01).

No: Go to Step (v).

(v) On CB1, open PITCH & ROLL (A6) circuit breaker. Interchange roll computers No. 2 and No. 1 (Ref. 22-13-01). Close A24 and A6 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) roll computer No. 2 (Ref. 22-13-01).

No: Go to Step (w).

(w) On CB1, open YAW SAS (A23) and (A5) circuit breakers. Interchange yaw computers No. 2 and No. 1 (Ref. 22-15-01). Close A24, A23, and A5 circuit breakers. Wait one full minute. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

No: Replace (previously identified) ILS receiver No. 2 (Ref. 34-33-01).

(x) From Step (t). On CB1, open RADIO ALTM (D22) and D4) circuit breakers. Interchange radio altimeter RTs No. 2 and No. 1 (Ref. 34-32-01). Close A24, D22, and D4 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace (previously identified) radio altimeter RT No. 2 (Ref. 34-32-01). Open A23, A25, A5, A6, and A7 circuit breakers and interchange (previously identified) lateral accelerometer and normal accelerometer No. 2 and No. 1 cables to bring system back to its original configuration.

No: Go to Step (y).

(y) On CB1, open PITCH & ROLL (A6) circuit breaker. Interchange cables to lateral accelerometer connectors No. 2 and No. 1 (Ref. 22-13-02). Close A24 and A6 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace lateral accelerometer unit (Ref. 22-13-02). Open A23, A25, A5, and A7 circuit breakers and interchange (previously identified) normal accelerometer No. 2 and No. 1 cables to bring system back to its original configuration.

No: Go to Step (z).

(z) On CB1, open TRIM AGMT - AC (A25) and (A7) circuit breakers. Interchange cables to normal accelerometer connectors No. 2 and No. 1 (Ref. 22-11-02). Close A24, A25, and A7 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace normal accelerometer unit (Ref. 22-11-02).

No: Replace trim augmentation computer (Ref. 22-18-01).

(aa) From Step (j). On CB1, open YAW SAS (A5), PITCH & ROLL (A6) and (A24), TRIM AGMT (A7) and (A25); on aircraft without INS, close VG/INS-1 (G6) and INS-3/GYRO-3 (E24) circuit breakers. On aircraft with INS, close VG/INS-1 (G6), INS PWR (E6), INS HTR (E7), INS-3/GYRO-3 (E24) and INS-3 HTR. On CB2, open FLIGHT STATION MISC - R AOA (F1) circuit breaker. In FESC, identify (No. 1 for inertial unit No. 1 (or vertical gyro No. 1), inertial unit No. 1 (or vertical gyro No. 1) (Ref. 34-43-03, 34-21-04) and inertial unit No. 3 (or vertical gyro No. 3) (Ref. 34-43-03, 34-21-04). On galley overhead, identify and then interchange cables connected to lateral accelerometer connectors No. 1 and No. 3 (Ref. 22-13-02, and normal accelerometer connectors No. 1 and No. 3 (Ref. 22-11-02). On CB1, CB2, close circuit breakers previously opened in this step. Wait until ATT flag on Capt ADI is out of view and VERTICAL GYRO 3 message on CAWP is removed, or wait one full minute, whichever is longer. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Fault causing DANA message display is in one of the sensors which were interchanged. Go to Step (ab).

No: Fault causing DANA message display is not due to a 3rd sensor fault or a fault in its associated airplane wiring. On CB1, open A5, A7, A24 and A25 circuit breakers. On CB2, open F1 circuit breaker. Interchange (previously identified) lateral accelerometer, and normal accelerometer No. 1 and No. 3 cables to bring system back to its original configuration. Restore Inertial Unit No. 1 (vertical gyro No. 1) and inertial unit No. 3 (vertical gyro No. 3) to original

configuration after opening associated circuit breakers. When the above procedures have been accomplished, close all circuit breakers previously opened.

(ab) Wait until ATT flag on Capt ADI is out of view and VERTICAL GYRO 3 message on CAWP is removed. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Go to Step (ac). Replace (previously identified) inertial unit No. 3 (vertical gyro No. 3) (Ref. 34-43-03,34-21-04).

No: On CB1, open A5, A7, A24, and A25 circuit breakers. On CB2, open F1 circuit breaker. Interchange (previously identified) lateral accelerometer, and normal accelerometer No. 1 and No. 3 cables to bring system back to its original configuration.

(ac) On CB1, open Pitch & Roll (A24) circuit breaker. Interchange cables to lateral accelerometer connectors No. 1 and No. 2. Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. On CAWP, is DANA message removed?

Yes: Replace normal accelerometer unit (Ref. 22-11-02). Open A7 and A25 circuit breakers. Interchange (previously identified) normal accelerometer No. 1 and No. 3 cables to bring system back to its original configuration.

No: Replace lateral accelerometer unit (Ref. 22-13-02). Open A24 circuit breaker. Interchange (previously identified) lateral accelerometer No. 1 and No. 3 cables to bring system back to its original configuration.

(ad) From Step (ac). Depress YAW SAS 1 and 2 switchlights to OFF. On CB1, open YAW SAS (A5) circuit breaker. Disconnect cable from YAW rate gyro No. 1. On CB1, close A5. Cycle YAW SAS 1

and 2 to on. Do both YAW SAS switchlights indicate FAIL?

Yes: Either YAW rate gyro No. 2 or No. 3 is faulty. Go to Step (ae).

No: Go to Step (af).

(ae) Depress YAW SAS 1 and 2 switchlights to OFF. On CB1, open YAW SAS (A5) and (A23) circuit breakers. Connect cable to YAW rate gyro No. 1. Disconnect cable from YAW rate gyro No. 2. On CB1, close A5 and A23. Cycle YAW SAS 1 and 2 switchlights to on. Do both YAW SAS switchlights indicate FAIL?

Yes: Replace YAW rate gyro No. 3 (Ref. 22-15-02) and connect cable to YAW rate gyro No. 2.

No: Replace YAW rate gyro No. 2 (Ref. 22-15-02).

(af) Depress YAW SAS 1 and 2 switchlights to OFF. On CB1, open YAW SAS (A5) and (A23) circuit breakers. Connect cable to YAW rate gyro No. 1. Disconnect cable from YAW rate gyro No. 2. On CB1, close A5 and A23. Cycle YAW SAS 1 and 2 switchlights to on. Do both YAW SAS switchlights indicate FAIL?

Yes: Replace YAW rate gyro No. 1 (Ref. 22-15-02), and connect cable to YAW rate gyro No. 2.

No: Connect cable to YAW rate gyro No. 2. Go to Step (ag).

(ag) On CB1, open AUTO THROT SERVO (A1), NO. 1 SYSTEMS - SPEED CONT (A2) and NO. 2 SYSTEMS - SPEED CONT (A20) circuit breakers. In FESC, remove speed control computer (Ref. 22-31-07). Close A6 circuit breaker. Set AP engage switch A to CWS. On CAWP, is DANA message displayed?

Yes: Go to Step (ah).

No: Replace speed control computer (Ref. 22-31-07).

(ah) On CB1, open PITCH & ROLL (A24) circuit breaker. In FESC, remove pitch computer No. 2 (Ref. 22-11-01). On pitch computer No. 2 rack connectors, verify the following voltages:

NA-3 J2B-20 to -32 Less than 10 MVDC

VG-3 (x-y) J2B-66 to -67 Less than 300 MVAC

VG-3 (y-z) J2B-66 to -54 Greater than 10 VAC

VG-3 (x-z) J2B-67 to -54 Greater than 10 VAC

Are voltage levels correct?

Yes: Go to Step (aj).

No: Go to Step (ai).

(ai) On CB1, open PITCH & ROLL (A6) circuit breaker. In FESC, remove pitch computer No. 1 (Ref. 22-11-01). On pitch computer No. 1 rack connectors, repeat the voltage measurements made in Step (ah). Are voltage levels correct?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Check aircraft wiring between inertial unit No. 3 (vertical gyro No. 3), and normal accelerometer No. 3, and pitch computers No. 1 and No. 1 and No. 2 as required (Ref. 22-11-00).

(aj) From Step (ah). On CB1, open PITCH & ROLL (A24) circuit breaker. In FESC, remove roll computer No. 2 (Ref. 22-13-01). Close A24 circuit breaker. On roll computer No. 2 rack connectors, verify the following voltages:

LA-3 J2B-19 to -31 Less than 10 MVDC

VG-3 (x-y) J2B-66 to -54 Less than 300 MVAC

VG-3 (y-z) J2B-66 to -67 Greater than 10 VAC

VG-3 (x-z) J2B-54 to -67 Greater than 10 VAC

Are voltage readings within limits?

Yes: Go to Step (al).

No: Go to Step (ak).

(ak) On CB1, open PITCH & ROLL (A6) circuit breaker. In FESC, remove roll computer No. 1 (Ref. 22-13-01). Close A6 circuit breaker. On roll computer No. 2 rack connectors, repeat voltage measurements made in Step (aj). Are measurements within limits?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Check aircraft wiring between inertial unit No. 3 (vertical gyro No. 3), and lateral accelerometer No. 3, and lateral accelerometer No. 3, and roll computers No. 1 and No. 2 as required (Ref. 22-13-01).

(al) From Step (aj). On CB1, open YAW SAS (A23) circuit breaker. On CB2, open R AOA (F1) circuit breaker. In FESC, remove yaw computer No. 2 (Ref. 22-15-01). Close F1 circuit breaker. On yaw computer No. 2 rack connectors, verify the following voltages:

YRG-3 J2B-14 to -24 Less than 30 MVAC

No. 3 REF J2B-4 to -9 24 (±4) VAC

Are voltage readings within limits?

Yes: Go to Step (an).

No: Go to Step (am).

(am) On CB1, open YAW SAS (A5) circuit breakers. On CB2, open R AOA (F1) circuit breaker. In FESC, remove yaw computer No. 1 (Ref. 22-15-01). Close F1 circuit breaker. On yaw computer No. 2 rack connectors, repeat voltage measurements made in Step (al). Are measurements within limits?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Check yaw rate gyro No. 3 and No. 3 VRG REF voltage specified in Step (al), and aircraft wiring between yaw computers No. 1 and No. 2, flight control electronics computer, and yaw rate gyro No. 3 (Ref. 22-15-00).

(an) From Step (al). On CB1, open PITCH & ROLL (A24) and YAW SAS (A23) circuit breakers. Install roll computer No. 2 (Ref. 22-13-01). Remove pitch computer No. 1 (Ref. 22-11-01). Install yaw computer No. 2 (Ref. 22-15-01). Close A24 and A23 circuit breakers. On pitch computer No. 1 rack connectors, verify the following voltages:

NA-3 J1B-20 to -32 Less than 10 MVDC

VG-3 (x-y) J1B-66 to -67 Less than 300 MVAC

VG-3 (y-z) J1B-66 to -54 Greater than 10 VAC

VG-3 (x-z) J1B-67 to -54 Greater than 10 VAC

Are voltage readings within limits?

Yes: Go to Step (ap).

No: Go to Step (ao).

(ao) On CB1, open PITCH & ROLL (A24) circuit breaker. In FESC, remove pitch computer No. 2 (Ref. 22-11-01). On pitch computer No. 1 rack connectors, repeat the voltage measurements made in Step (an). Are voltage levels correct?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Check aircraft wiring between vertical gyro No. 3, and normal accelerometer No. 3, and pitch computers No. 1 and No. 2 as required (Ref. 22-11-00).

(ap) From Step (an). On CB1, open PITCH & ROLL (A6) circuit breaker. In FESC, remove roll computer No. 1 (Ref. 22-13-01). Close A6 circuit breaker. On roll computer No. 1 rack connectors, verify the following voltages:

LA-3 J1B-19 to -31 Less than 10 MVDC

VG-3 (x-y) J1B-66 to -54 Less than 300 MVAC

VG-3 (y-z) J1B-66 to -67 Greater than 10 VAC

VG-3 (x-z) J1B-54 to -67 Greater than 10 VAC

Are voltage readings within limits?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01). If problem persists, check aircraft wiring for yaw rate gyro No. 3 and No. 3YRG REF voltage, specified in Step (al) above, and between yaw computers No. 1 and No. 2, flight control electronics computers, and yaw rate gyro No. 3 (Ref. 22-15-00).

No: Go to Step (aq).

(aq) On CB1, open PITCH & ROLL (A24) circuit breaker. In FESC, remove roll computer No. 2 (Ref.

22-13-01). On roll computer No. 2 rack connectors, repeat voltage measurements made in Step (ap). Are measurements within limits?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Check aircraft wiring between inertial unit No. 3 (vertical gyro No. 3), and lateral accelerometer No. 3 and roll computers No. 1 and No. 2 as required (Ref. 22-13-00).

---

(18) Fault: AP DISC or ALERT not displayed on AFCS WARNING indicator.

(a) Perform AFCS lamps and annunciators test (Ref. 22-10-31).

---

(19) Fault: Aural warning does not sound or will not stop.

(a) Check for fault in aural warning system (Ref. 31-21-00).

---

(20) Fault: AP engage switch B cannot be raised to CWS.

(a) Perform fault isolation procedure in 22-10-35 for Fault (4).

---

(21) Fault: AP engage switch B will not hold in CWS.

(a) Perform fault isolation procedure in 22-10-35 for Fault (5).

---

(22) Fault: AP LIMIT message is displayed.

(a) Perform fault isolation procedure in 22-10-35 for Fault (5).

---

(23) Fault: Control column position changes.

(a) Perform fault isolation procedure in 22-10-35 for Fault (7).

---

(24) Fault: Control wheel position changes.

(a) Perform fault isolation procedure in 22-10-35 for Fault (8).

---

(25) Fault: ADI fault indication.

(a) Perform relevant fault isolation procedure in 22-10-31 for Capt or F/O ADI.

---

(26) Fault: ADI indications are incorrect or do not agree.

(a) Check ADIs and ILS receivers for fault (Ref. 34-33-00).

---

(27) Fault: HSI indications are incorrect or do not agree.

(a) Check HSIs and ILS receivers for fault (Ref. 34-33-00).

---

(28) Fault: DANA message on CAWP.

(a) Engage dual channel AUTOLAND track mode and then disengage as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (b).

No: Fault causing DANA message display is associated with side 2 (F/O) AFCS. Go to Step (d).

(b) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for

side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers. On ramp test set, adjust LOC for a 1-dot steer-left indication on Capt HSI, and then reset to zero deviation. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

Open PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (c).

No: Replace (previously identified) roll computer No. 1 (Ref. 22-13-01).

(c) On CB1, close PITCH & ROLL (A6) circuit breaker, and open No. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and A23) circuit breakers. In FESC, identify and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5 and A23 circuit breakers. On ramp test set, adjust LOC for a 1-dot steer-left indication on Capt HSI, and then reset to zero deviation. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

Open PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Replace ILS receiver No. 1 (Ref. 34-33-01).

No: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

(d) From Step (a). On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers. On ramp test set, adjust LOC for a 1-dot steer-left indication on Capt HSI, and then reset to zero deviation. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

Open PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (e).

No: Replace (previously identified) roll computer No. 2 (Ref. 22-13-01).

(e) On CB1, close PITCH & ROLL (A24) circuit breaker, and open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5 and A23 circuit breakers. On ramp test set, adjust LOC for a 1-dot steer-left indication on Capt HSI, and then reset to zero deviation. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

Open PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Replace ILS receiver No. 2 (Ref. 34-33-01).

No: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

---

(29) Fault: ADI indications are incorrect or do not agree.

(a) Check ADIs and ILS receivers for fault (Ref. 34-33-01).

---

(30) Fault: HSI indications are incorrect or do not agree.

(a) Check HSIs or ILS receivers for fault (Ref. 34-33-01).

---

(31) Fault: DANA message is displayed.

(a) Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (b).

No: Fault causing DANA message is associated with side 2 (F/O) AFCS. Go to Step (c).

(b) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. On ramp test set, adjust GS for a 1-dot steer-up indication on Capt HSI, and then reset to zero deviation. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

Open PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Replace ILS receiver No. 1 (Ref. 34-33-01).

No: Replace (previously identified) pitch computer No. 1 (Ref. 22-11-01).

(c) From Step (a). On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. On ramp test set, adjust GS for a 1-dot steer-up indication on Capt HSI, and then reset to zero deviation. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

Open PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Replace ILS receiver No. 2 (Ref. 34-33-01).

No: Replace (previously identified) pitch computer No. 2 (Ref. 22-11-01).

---

(32) Fault: A/L switchlight not illuminated.

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated A/L switchlight fault?

Yes: Replace NAV MODE panel (Ref. 22-10-02).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(33) Fault: On Capt AFCS MODES annunciator, LOC ARM message not displayed.

(a) On Capt AFCS MODES annunciator, is LOC message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Set FD switch A to ON. Depress A/L switchlight to on. On Capt AFCS MODES annunciator, is LOC message displayed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated LOC ARM message fault?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure, (Ref. 22-02-01).

---

(34) Fault: On Capt AFCS MODES annunciator, GS ARM message not displayed.

(a) On Capt AFCS MODES annunciator, is GS message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Set FD switch A to ON. Depress A/L switchlight to on. On Capt AFCS MODES annunciator, is GS message displayed?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciator press-to-test procedure (Ref. 22-02-01) be performed with no indicated GS ARM message fault?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace roll computer No. 1 (Ref. 22-13-01). If problem still persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(35) Fault: On F/O AFCS MODES annunciator, LOC ARM message not displayed.

(a) On F/O AFCS MODES annunciator, is LOC message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Set FD switch B to ON. Depress A/L switchlight to on. On F/O AFCS MODES annunciator, is LOC message displayed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, ILS system No. 2 is suspected

of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated LOC ARM message fault?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(36) Fault: On F/O AFCS MODES annunciator, GS ARM message not displayed.

(a) On F/O AFCS MODES annunciator, is GS message displayed?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Set both FD switches to OFF. On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Set FD switch B to ON. Depress A/L switchlight to ON. On F/O AFCS MODES annunciator, is GS message displayed?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

(c) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated GS ARM message fault?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace roll computer No. 2 (Ref. 22-13-01). If problem still persists, replace F/O AFCS MODE annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(37) Fault: On Capt AFCS WARNING indicator, NO FLARE message is not displayed.

(a) Replace Capt AFCS WARNING indicator (Ref. 22-10-06).

---

(38) Fault: On F/O AFCS WARNING indicator, NO FLARE message is not displayed.

(a) Replace F/O AFCS WARNING indicator (Ref. 22-10-06).

---

(39) Fault: On Capt AFCS MODES annunciator, LOC message not displayed.

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated LOC message fault?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace Capt AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(40) Fault: On F/O AFCS MODES annunciator, LOC messages not displayed.

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed with no indicated LOC message fault?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace F/O AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(41) Fault: On Capt ADI, FD flag displayed.

(a) On Capt HSI, is NAV flag displayed?

Yes: ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(42) Fault: On Capt ADI, FD command bar is not level.

(a) Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, ILS system No. 1 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(43) Fault: On F/O ADI, FD flag displayed.

(a) On F/O HSI, is NAV flag displayed?

Yes: ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

No: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, ILS system No. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(44) Fault: On F/O ADI, FD command bar is not level.

(a) Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace NAV MODE panel (Ref. 22-10-02). If problem still persists, ILS system

NO. 2 is suspected of being faulty (Ref. 34-33-00 for fault isolation).

---

(45) Fault: On Capt ADI, command bar does not move.

(a) Can Steps (1) through (5) of FD heading select mode test procedure (Ref. 22-13-31) be performed with no indicated fault?

Yes: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace VHF NAV accessory unit (Ref. 34-55-06). If problem still persists, replace NAV MODE panel (Ref. 22-10-02).

No: Perform 22-13-31 fault isolation.

---

(46) Fault: On Capt ADI, command bar does not level.

(a) Replace roll computer No. 1 (Ref. 22-13-01).

---

(47) Fault: DANA message on CAWP.

(a) On NAV MODE panel, set Capt COURSE knob to aircraft heading. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (b).

No: Fault causing DANA message display is associated with side 2 (F/O) AFCS. Go to Step (c).

(b) On CB1, open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5, A6, and A23 circuit breakers. On ramp test set, adjust GS for a 1-dot steer-up deviation indication on Capt HSI. Set FD engage switches A and B to ON. On NAV MODE panel,

depress A/L switchlight to on, and wait one full minute. On NAV MODE panel, rapidly rotate Capt COURSE knob clockwise 40 degrees from aircraft heading, and then reset to aircraft heading. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. Is DANA message display removed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

(c) From Step (a). On CB1, open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5, A24, and A23 circuit breakers. On ramp test set, adjust GS for a 1-dot steer-up deviation indication on Capt HSI. Set FD engage switches A and B to ON. On NAV MODE panel, depress A/L switchlight to on, and wait one full minute. On NAV MODE panel, rapidly rotate Capt COURSE knob clockwise 40 degrees from aircraft heading, and then reset to aircraft heading. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. Is DANA message display removed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

---

(48) Fault: On Capt AFCS WARNING indicator, NO ALIGN message not displayed.

(a) Replace AFCS WARNING indicator (Ref. 22-10-06).

(49) Fault: On F/O AFCS WARNING indicator, NO ALIGN message not displayed.

(a) Replace F/O AFCS WARNING indicator (Ref. 22-10-06).

---

(50) Fault: On F/O ADI, command bar does not move.

(a) Can Steps (1) through (5) of FD heading select mode test procedure (Ref. 22-13-31) be performed with no indicated fault?

Yes: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace VHF NAV accessory unit (Ref. 34-55-06). If problem persists, replace NAV MODE panel (Ref. 22-10-02).

No: Perform 22-13-31 fault isolation.

---

(51) Fault: On F/O ADI, command bar does not level.

(a) Replace roll computer No. 2 (Ref. 22-13-01).

---

(52) Fault: DANA message on CAWP.

(a) On NAV MODE panel, set F/O COURSE knob to aircraft heading. Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (b).

No: Fault causing DANA message display is associated with side 2 (F/O) AFCS. Go to Step (c).

(b) On CB1, open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and

then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5, A6, and A23 circuit breakers. On ramp test set, adjust GS for a 1-dot steer-up deviation indication on Capt HSI. Set FD engage switches A and B to ON. On NAV MODE panel, depress A/L switchlight to on, and wait one full minute. On NAV MODE panel, rapidly rotate F/O COURSE knob clockwise 40 degrees from aircraft heading, then reset to aircraft heading. Engage dual channel AUTOLAND track and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A6) circuit breaker. Is DANA message display removed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

(c) From Step (a). On CB1, open No. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5, A24, and A23 circuit breakers. On ramp test set, adjust GS for a 1-dot steer-up deviation indication on Capt HSI. Set FD engage switches A and B to ON. On NAV MODE panel, depress A/L switchlight to on, and wait one full minute. On NAV MODE panel, rapidly rotate F/O COURSE knob clockwise 40 degrees from aircraft heading, and then reset to aircraft heading. Engage dual channel AUTOLAND track and then disengage autopilots as described at beginning of Paragraph 5B.

On CB1, open PITCH & ROLL (A24) circuit breaker. Is DANA message display removed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

---

(53) Fault: On Capt ADI, command bar does not move.

(a) Replace roll computer No. 1 (Ref. 22-13-01).

(54) Fault: On F/O ADI, command bar does not move.

(a) Replace roll computer No. 2 (Ref. 22-13-01).

---

(55) Fault: On Capt AFCS MODES annunciator, GS message not displayed.

(a) Can Steps (3) and (4) of AFCS lamps and annunciators test procedure (Ref. 22-02-01) be performed with no GS message fault?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace AFCS MODES annunciator (Ref. 22-10-05).

No: Perform 22-02-01 fault isolation.

---

(56) Fault: On F/O AFCS MODES annunciator, GS message not displayed.

(a) Can Steps (3) and (4) of AFCS lamps and annunciators test procedure (Ref. 22-02-01) be performed with no GS message fault?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace AFCS MODES annunciator (Ref. 22-10-05).

No: Perform 22-02-01 fault isolation.

---

(57) Fault: On Capt ADI, command bar not taken out of view.

(a) Replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, check radio altimeter No. 1 for fault (Ref. 34-32-00).

---

(58) Fault: On F/O ADI, command bar not taken out of view.

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, check radio altimeter No. 2 for fault (Ref. 34-32-00).

(59) Fault: DANA message on CAWP.

(a) Engage dual channel AUTOLAND track mode and then disengage both autopilots as described at beginning of Paragraph 5B.

On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (b).

No: Fault causing DANA message display is associated with side 2 (F/O) AFCS. Go to Step (c).

(b) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. Set FD engage switches A and B to ON. On ramp test set, adjust GS for a 1-dot steer-up indication on Capt HSI. On NAV MODE panel, depress A/L switchlight to on. When LOC messages are displayed on AFCS MODES annunciators, adjust GS on ramp test set for a zero deviation indication on Capt HSI. When GS messages are displayed on AFCS MODES annunciators, engage dual channel AUTOLAND track and then disengage both flight directors and autopilot as described at beginning of Paragraph 5B. Open PITCH & ROLL (A6) circuit breaker. Is DANA message display removed?

Yes: Replace ILS receiver No. 1 (Ref. 34-33-01).

No: Replace pitch computer No. 1 (Ref. 22-11-01).

(c) From Step (a). On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. Set FD engage switches A and B to ON. On ramp test set, adjust GS for a 1-dot steer-up indication on Capt HSI. On NAV MODE panel, depress A/L switchlight to on. When LOC messages are displayed on AFCS MODES annunciators, adjust GS on ramp test set for a zero deviation

indication on Capt HSI. When GS messages are displayed on AFCS MODES annunciators, engage dual channel AUTOLAND track and then disengage both flight directors and autopilot as described at beginning of Paragraph 5B. Open PITCH & ROLL (A24) circuit breaker. Is DANA message display removed?

Yes: Replace ILS receiver No. 2 (Ref. 34-33-01).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

---

(60) Fault: AP engage switch B cannot be set to CMD.

(a) Replace pitch computer No. 2 (Ref. 22-11-01). Repeat test. Can switch be raised to CMD?

Yes: Fault condition in original computer.

No: Replace APFDS ENGAGE panel (Ref. 22-10-01).

---

(61) Fault: Pitch trim wheels rotate.

(a) Replace AFCS/MLG accessory unit (Ref. 22-10-11). If problem persists, check trim system for fault (Ref. 22-18-00).

---

(62) Fault: On Capt AFCS MODES annunciator, A/L or FLARE message not displayed.

(a) Can AFCS lamps and annunciators test procedure (Ref. 22-02-01) be performed with no indicated A/L or FLARE message fault?

Yes: For A/L message fault, replace roll computer No. 1 (Ref. 22-13-01). For FLARE message fault, replace pitch computer No. 1 (Ref. 22-11-01). If problem persists, replace AFCS MODES annunciator (Ref. 22-10-05).

No: Perform 22-02-01 fault isolation.

---

(63) Fault: On F/O AFCS MODES annunciator, A/L or FLARE message not displayed.

(a) Can AFCS lamps and annunciators test procedure (Ref. 22-02-01) be performed with no indicated A/L or FLARE message fault?

Yes: For A/L message fault, replace roll computer No. 2 (Ref. 22-13-01). For FLARE message fault, replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace AFCS MODES annunciator (Ref. 22-10-05).

No: Perform 22-02-01 fault isolation procedure.

---

(64) Fault: On Capt AFCS MODES annunciator, ALIGN or ROLLOUT message not displayed.

(a) Can AFCS lamp and annunciators test procedure (Ref. 22-02-01) be performed with no indicated ALIGN or ROLLOUT message fault?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01). If problem persists, replace roll computer No. 1 (Ref. 22-13-01), then AFCS MODES annunciator (Ref. 22-10-05).

No: Perform 22-02-01 fault isolation procedure.

---

(65) Fault: On F/O AFCS MODES annunciator, ALIGN or ROLLOUT message not displayed.

(a) Can AFCS lamps and annunciator test procedure (Ref. 22-02-01) be performed with no indicated ALIGN or ROLLOUT message fault?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01). If problem persists, replace roll computer No. 2 (Ref. 22-13-01), then AFCS MODES annunciator (Ref. 22-10-05).

No: Perform 22-02-01 fault isolation procedure.

---

(66) Fault: On Capt or F/O AFCS WARNING indicator, NO ALIGN message not removed.

(a) On CAWP, is DANA message displayed?

Yes: Go to Fault (71).

No: Go to Step (b).

(b) Is message removed from other indicator?

Yes: Replace faulted AFCS WARNING indicator (Ref. 22-10-06).

No: Replace yaw computer No. 2 (Ref. 12-15-01). If problem persists, replace yaw computer No. 1 (Ref. 22-15-01).

---

(67) Fault: On Capt or F/O AFCS WARNING indicator, NO FLARE message not removed.

(a) On CAWP, is DANA message displayed?

Yes: Go to Fault (71).

No: Go to Step (b).

(b) Is message removed from other indicator?

Yes: Replace faulted AFCS WARNING indicator (Ref. 22-10-06).

No: Replace roll computer No. 2 (Ref. 22-13-01). If problem persists, replace roll computer No. 1 (Ref. 22-13-01).

---

(68) Fault: On Capt AFCS WARNING indicator, NO DUAL message not displayed.

(a) Replace AFCS WARNING indicator (Ref. 22-10-06).

---

(69) Fault: On F/O AFCS WARNING indicator, NO DUAL message not displayed.

(a) Replace AFCS WARNING indicator (Ref. 22-10-06).

---

(70) Fault: On both AFCS WARNING indicators, AP LIMIT message displayed.

(a) Replace pitch computer No. 2 (Ref. 22-11-01). If problem persists, replace pitch computer No. 1 (Ref. 22-11-01).

---

(71) Fault: DANA message on CAWP.

(a) On FCES panel, does either YAW SAS switchlight indicate FAIL?

Yes: Go to Step (t).

No: Go to Step (b).

(b) On FCES panel, does either PITCH TRIM switchlight indicate FAIL?

Yes: Go to Step (ab).

No: Go to Step (c).

(c) On AFCS WARNING indicators, is NO ALIGN message displayed?

Yes: Go to Step (ah).

No: Go to Step (d).

(d) On AFCS WARNING indicator, is NO FLARE message displayed?

Yes: Go to Step (aq).

No: Go to Step (e).

(e) Set FD and AP engage switches A and B to OFF. On CB1, open and then close NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (f).

No: Fault causing DANA message display is associated with side 2 (F/O) AFCS. Go to Step (m).

(f) During the following procedure, prepare to observe whether the NO DUAL or DANA message is displayed first.

Connect radio altimeter test set as follows:

On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

On test set, set TEST SELECT switch to OFF.

In mid electrical service center, connect test set plug P2 to TEST connector on radio altimeter RT No. 1. Connect test set plug P1 to TEST connector on radio altimeter RT No. 2.

Close D4 and D22 circuit breakers.

Using test set, establish an altitude of 480 (±20) feet as indicated on instrument panel radio altitude indicators.

Engage dual channel AUTOLAND mode as follows:

Set AP engage switch B to CMD.

Depress A/L switchlight to on, and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciator, LOC ARM, GS ARM and A/L ARM messages are temporarily displayed. After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

On CAWP, DANA message is displayed.

NOTE: Control column and wheel motions, pitch trim wheel motion, and display of AP LIMIT messages on AFCS WARNING indicators may be ignored.

Was the NO DUAL message displayed first?

Yes: Go to Step (g).

No: Go to Step (i).

(g) On CB1, open and then close NO. 2 SYSTEMS - YAW SAS (A23) circuit breaker. On FCES panel, is YAW SAS 1 switchlight FAIL legend illuminated?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Go to Step (h).

(h) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers.

On radio altimeter test set, set altitude to zero feet as indicated on Capt RAI.

Engage single channel AUTOLAND mode as follows:

Set AP engage switch B to CMD.

Depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM and A/L ARM messages are temporarily displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L and ALIGN, FLARE and ROLLOUT messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

On CAWP, DANA message is displayed.

NOTE: Control column and wheel motions, pitch trim wheel motion, and display of AP LIMIT messages on AFCS WARNING indicators may be ignored. Set AP engage switch B to OFF.

RESULT:

On both AFCS MODES annunciators, all messages are removed.

On both AFCS WARNING indicators, NO DUAL messages are removed and AP DISC messages are displayed.

On CB1, open and then close NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Replace (previously identified) pitch computer No. 1 (Ref. 22-11-01).

(i) From Step (f). On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h).

On CB1, open and then close NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (k).

No: Replace (previously identified) pitch computer No. 1 (Ref. 22-11-01).

(j) On CB1, open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5 and A23 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h).

On CB1, open and then close NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (l).

No: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

(k) On CB1, open NO. 1 and NO. 2 NAVIGATION - RADIO ALTM (D4) and (D22) circuit breakers. In mid electrical service center, identify (No. 1 for side 1, No. 2 for side 2) and then interchange radio altimeter RTs No. 1 and No. 2 (Ref. 34-32-01). Close D4 and D22 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h).

On CB1, open and then close NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (l).

No: Replace (previously identified) radio altimeter RT No. 1 (Ref. 34-32-01).

(l) Replace pitch autopilot servo No. 1 high pitch force solenoid (hydro B) (Ref. 22-11-09).

Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h).

On CAWP, is DANA message displayed?

Yes: Replace pitch autopilot servo No. 1 high pressure hook switch (hydro B) (Ref. 22-11-09).

No: Original high pitch force solenoid is faulty.

(m) From Step (e). During the following procedure, prepare to observe whether the NO DUAL or DANA message is displayed first. On radio altimeter test set, set altitude to 480 (±20) feet as indicated on Capt RAI.

Engage single channel AUTOLAND as follows:

Set AP engage switch B to CMD.

Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM and A/L ARM messages are temporarily displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

On CAWP, DANA message is displayed.

NOTE: Control column and wheel motion, pitch trim wheel motion, and display of AP LIMIT messages on AFCS WARNING indicators may be ignored.

Was the NO DUAL message displayed first?

Yes: Go to Step (n).

No: Go to Step (p).

(n) On CB1, open and then close NO. 1 SYSTEMS - YAW SAS (A23) circuit breaker. On FCES panel, is YAW SAS 2 switchlight FAIL legend illuminated?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01).

No: Go to Step (o).

(o) On CB1, open PITCH & ROLL (A6) and A24) circuit breakers. In FESC, identify (No. 1 for side 1, and No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers.

On radio altimeter test set, set altitude to zero feet as indicated on Capt RAI.

Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h).

On CB1, open and then close NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace (previously identified) pitch computer No. 2 (Ref. 22-11-01).

(p) From Step (m). On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h).

On CB1, open and then close NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (q).

No: Replace (previously identified) pitch computer No. 2 (Ref. 22-11-01).

(q) On CB1, open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5 and A23 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h).

On CB1, open and then close NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (r).

No: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

(r) On CB1, open NO. 1 and NO. 2 NAVIGATION - RADIO ALTM (D4) and (D22) circuit breakers. In mid electrical service center, identify (No. 1 for side 1, No. 2 for side 2) and then interchange radio altimeter RTs No. 1 and No. 2 (Ref. 34-32-01). Close D4 and D22 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD), and then disengage autopilot B as described in Step (h). On CB1, open and then close NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breakers. Is DANA message removed?

Yes: Go to Step (s).

No: Replace (previously identified) radio altimeter RT No. 2 (Ref. 34-32-01).

(s) Replace pitch autopilot servo No. 2 high pitch force solenoid (hydro A) (Ref. 22-11-09).

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On CAWP, is DANA message displayed?

Yes: Replace pitch autopilot servo No. 2 high pressure hook switch (hydro A) (Ref. 22-11-09).

No: Original high pitch force solenoid is faulty.

(t) From Step (a). Is YAW SAS 1 switchlight FAIL legend illuminated?

Yes: Go to Step (u).

No: Go to Step (w).

(u) On CB1, open PITCH & ROLL (A6) and (A24), and NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify and then interchange yaw computers No. 1 and No. 2. Close A5, A6, A23, and A24 circuit breakers. Wait one full minute.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES panel, is YAW SAS 1 switchlight FAIL legend illuminated?

Yes: Go to Step (v).

No: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

(v) On CB1, open NO. 1 and NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES panel, is YAW SAS 1 switchlight FAIL legend illuminated?

Yes: Replace dual rudder position transducer No. 1 (Ref. 22-15-03).

No: Replace (previously identified) roll computer No. 1 (Ref. 22-13-01).

(w) From Step (t). On CB1, open PITCH & ROLL (A6) and (A24), and NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify and then interchange yaw computers No. 1 and No. 2. Close A5, A6, A23, and A24 circuit breakers. Wait one full minute.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES Panel, is YAW SAS 2 switchlight FAIL legend illuminated?

Yes: Go to Step (x).

No: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

(x) On CB1, open NO. 1 and NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES panel, is YAW SAS 2 switchlight FAIL legend illuminated?

Yes: Go to Step (y).

No: Replace (previously identified) roll computer No. 2 (Ref. 22-13-01).

(y) Replace APFDS ENGAGE panel (Ref. 22-10-01). On CB1, open NO. 1 and NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES panel, is YAW SAS 2 switchlight FAIL legend illuminated?

Yes: Go to Step (z).

No: Original APFDS ENGAGE panel is faulted.

(z) Replace No. 2 rudder servo hook engage solenoid (Hydro A) (Ref. 27-21-08). On CB1, open NO. 1 and NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES panel, is YAW SAS 2 switchlight FAIL legend illuminated?

Yes: Go to Step (aa).

No: Original solenoid is faulted.

(aa) Replace No. 2 rudder servo hook engage pressure switch (Hydro A) (Ref. 27-21-08). Replace APFDS ENGAGE panel (Ref. 22-10-01). From Step (u). On CB1, open NO. 1 and No. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES Panel, is YAW SAS 2 switchlight FAIL legend illuminated?

Yes: Replace dual rudder position transducer No. 2 (Ref. 22-15-03).

No: Original pressure switch faulted.

(ab) From Step (b). Set FD engage switches A and B and AP engage switch B to OFF. On FCES panel, depress PITCH TRIM 1 and 2 switchlights to OFF. Depress PITCH TRIM 1 switchlight to on (dark). On Capt control wheel, rotate trim thumbwheel for nose-up trim. Does PITCH TRIM 1 switchlight indicate FAIL?

Yes: Check pitch trim system for fault (Ref. 22-18-00).

No: Go to Step (ac).

(ac) On F/O control wheel, rotate trim thumbwheel for nose-down trim. Does PITCH TRIM 1 switchlight indicate FAIL?

Yes: Check pitch trim system for fault (Ref. 22-18-00).

No: Go to Step (ad).

(ad) On FCES panel, depress PITCH TRIM 1 switchlight to OFF, and PITCH TRIM 2 switchlight to on. On F/O control wheel, rotate trim thumbwheel for nose-up trim. Does PITCH TRIM 2 switchlight indicate FAIL?

Yes: Check pitch trim system for fault (Ref. 22-18-00).

No: Go to Step (ae).

(ae) On Capt control wheel, rotate pitch trim thumbwheel for nose-down trim. Does PITCH TRIM 1 switchlight indicate FAIL?

Yes: Check pitch trim system for fault (Ref. 22-18-00).

No: Go to Step (af).

(af) Replace trim augmentation computer (Ref. 22-18-01). On CB1, open and then close NO. 1 and

NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES panel, does either PITCH TRIM switchlight indicate FAIL?

Yes: Go to Step (ag).

No: Original trim computer is faulted.

(ag) Replace roll computer No. 2 (Ref. 22-13-01). On CB1, open and then close PITCH & ROLL (A6) circuit breaker.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

On FCES panel, does either PITCH TRIM switchlight indicate FAIL?

Yes: Replace roll computer No. 1 (Ref. 22-13-01).

No: Original roll computer No. 2 is faulted.

(ah) From Step (c). Set AP engage switch A to CMD. On AFCS WARNING indicators, are NO ALIGN messages removed?

Yes: Go to Step (am).

No: Go to Step (ai).

(ai) On HSIs 1 and 2, do indicated aircraft headings agree to within 6 degrees?

Yes: Go to Step (aj).

No: Set aircraft heading to agree.

(aj) On NAV MODE panel, are both COURSE knobs set to aircraft heading?

Yes: Go to Step (ak).

No: Set both COURSE knobs to aircraft heading.

(ak) Replace NAV MODE panel (Ref. 22-10-02).

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO ALIGN messages displayed?

Yes: Go to Step (al).

No: Original NAV MODE panel is faulted.

(al) Replace yaw computer No. 2 (Ref. 22-15-01). On CB1, open and then close NO. 1 and NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. Wait one full minute.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO ALIGN messages displayed?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Original yaw computer No. 2 is faulted.

(am) From Step (ah). Replace yaw computer No. 2 (Ref. 22-15-01). On CB1, open and then close NO. 1 and NO. 2 SYSTEMS - PITCH & ROLL (A6) and (A24) circuit breakers. Wait one full minute.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO ALIGN messages displayed?

Yes: Go to Step (an).

No: Original yaw computer No. 2 is faulted.

(an) Replace roll computer No. 2 (Ref. 22-13-01). On CB1, open and then close PITCH & ROLL (A6) circuit breaker.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO ALIGN messages displayed?

Yes: Go to Step (ao).

No: Original roll computer No. 2 is faulted.

(ao) Replace APFDS ENGAGE panel (Ref. 22-10-01).

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO ALIGN messages displayed?

Yes: Go to Step (ap).

No: Original panel is faulted.

(ap) Replace rudder servo No. 2 hook engage solenoid (Hydro A) (Ref. 27-21-08). On CB1, open and then close PITCH & ROLL (A6) and (A24) circuit breakers.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO ALIGN messages displayed?

Yes: Replace rudder servo No. 2 hook pressure switch.

No: Original engage solenoid is faulted.

(aq) From Step (d). On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Are NO FLARE messages removed?

Yes: Go to Step (ar).

No: Go to Step (as).

(ar) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 circuit breaker.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO FLARE messages displayed?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Replace (previously identified) roll computer No. 1 (Ref. 22-13-01).

(as) From Step (aq). On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and

interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A24 circuit breaker.

Engage single channel AUTOLAND (AP engage switch B to CMD) as described in Step (h).

Are NO FLARE messages displayed?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01).

No: Replace (previously identified) roll computer No. 2 (Ref. 22-13-01).

---

(72) Fault: On AFCS WARNING indicators, NO DUAL message is not removed.

(a) On CAWP, is DANA message displayed?

Yes: Go to Fault (73).

No: Replace roll computer No. 1 (Ref. 22-13-01). If problem persists, replace roll computer No. 2 (Ref. 22-13-01).

---

(73) Fault: DANA message on CAWP.

(a) Set FD and AP engage switches A and B to OFF. On CB1, open and close NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message display removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (b).

No: Fault causing DANA message display is associated with side 2 (F/O) AFCS. Go to Step (k).

(b) During the following procedure, prepare to observe whether the NO DUAL or DANA message is displayed first.

Connect radio altimeter test set as follows:

On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

On test set, set TEST SELECT switch to OFF.

In mid electrical service center, connect test set plug P2 to TEST connector on radio altimeter RT No. 1. Connect test set plug P1 to TEST connector on radio altimeter RT No. 2.

Close D4 and D22 circuit breakers.

Using test set, establish an altitude of 480 (±20) feet as indicated on instrument panel radio altitude indicators.

Engage dual channel AUTOLAND mode as follows:

Set AP engage switch B to CMD.

Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM and A/L ARM messages are temporarily displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALN ARM and FLR ARM messages are displayed.

On both AFCS WARNING indicators, NO DUAL messages are displayed.

On CAWP, DANA message is displayed.

NOTE: Control column and wheel motions, pitch trim wheel motion, and display of AP LIMIT messages on AFCS WARNING indicators may be ignored.

Was the NO DUAL message displayed first?

Yes: Go to Step (c).

No: Go to Step (g).

(c) Set AP engage switches A and B to OFF. On CB1, open and close PITCH & ROLL (A6) circuit breaker, then open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5)

and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange yaw computers No. 1 and No. 2. Close A5 and A23 circuit breakers. Wait one full minute. On radio altimeter test set, adjust altitude to zero feet as indicated on Capt RAI.

Engage dual channel AUTOLAND track mode as follows:

Set AP engage switch B to CMD.

Depress A/L switchlight to on and immediately set AP engage switch A to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM and A/L ARM messages are temporarily displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L and ALIGN, FLARE and ROLLOUT messages are displayed.

On CAWP, DANA message is displayed.

NOTE: Control column and wheel motions, pitch trim wheel motion, and display of AP LIMIT messages on AFCS WARNING indicators may be ignored.

Set AP engage switches A and B to OFF.

RESULT:

On both AFCS MODES annunciators, all messages are removed.

On both AFCS WARNING indicators, NO DUAL messages are removed and AP DISC messages are displayed.

On CAWP, DANA message is displayed.

On CB1, open and close NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (d).

No: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

(d) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (1).

No: Replace (previously identified) roll computer No. 1 (Ref. 22-13-01).

(e) Replace APFDS ENGAGE panel (Ref. 22-10-01). Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Original panel is faulted.

No: Go to Step (f).

(f) Replace rudder servo No. 1 parallel hook engage solenoid (Hydro B) (Ref. 27-21-08). Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Original hook solenoid is faulted.

No: Replace rudder servo No. 1 parallel hook pressure switch (Hydro B) (Ref. 27-21-08).

(g) From Step (b). Set AP engage switches A and B to OFF. On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (h).

No: Replace (previously identified) pitch computer No. 1 (Ref. 22-11-01).

(h) On CB1, open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC identify and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5 and A23 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (i).

No: Replace (previously identified) yaw computer No. 1 (Ref. 22-15-01).

(i) On CB1, open NO. 1 and NO. 2 NAVIGATION - RADIO ALTM (D4) and (D22) circuit breakers. In mid electrical service center, identify and then interchange radio altimeter RTs No. 1 and No. 2 (Ref. 34-32-01). Close D4 and D22 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (j).

No: Replace (previously identified) radio altimeter RT No. 1 (Ref. 34-32-01).

(j) Replace pitch autopilot servo No. 1 high force hook engage solenoid (Hydro B) (Ref. 22-11-09). Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Original servo high force engage solenoid is faulted.

No: Replace pitch autopilot servo No. 1 high hook pressure switch (Hydro B) (Ref. 22-11-09).

(k) From Step (a). During the following procedure, prepare to observe whether the NO DUAL or DANA message is displayed first.

On radio altimeter test set, set altitude to 480 (±20) feet as indicated on Capt RAI.

Engage dual channel AUTOLAND mode as described in Step (b).

Was the NO DUAL message displayed first?

Yes: Go to Step (1).

No: Go to Step (p).

(1) Set AP engage switches A and B to OFF. On CB1, open and close PITCH & ROLL (A24) circuit breaker, then open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange yaw computers No. 1 and No. 2. Close A5 and A23 circuit breakers. Wait one full minute.

On radio altimeter test set, adjust altitude to zero feet as indicated on Capt RAI.

Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c).

On CB1, open and close NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (m).

No: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

(m) On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify and then interchange roll computers No. 1 and No. 2 (Ref. 22-13-01). Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (n).

No: Replace (previously identified) roll computer No. 2 (Ref. 22-13-01).

(n) Replace APFDS ENGAGE panel (Ref. 22-10-01). Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Original panel is faulted.

No: Go to Step (o).

(o) Replace rudder servo No. 2 parallel hook engage solenoid (Hydro B) (Ref. 27-21-08). Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Original hook solenoid is faulted.

No: Replace rudder servo No. 2 parallel hook pressure switch (Hydro A) (Ref. 27-21-08).

(p) From Step (k). Set AP engage switches A and B to OFF. On CB1, open PITCH & ROLL (A6) and (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange pitch computers No. 1 and No. 2 (Ref. 22-11-01). Close A6 and A24 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (q).

No: Replace (previously identified) pitch computer No. 2 (Ref. 22-11-01).

(q) On CB1, open NO. 1 and NO. 2 SYSTEMS - YAW SAS (A5) and (A23) circuit breakers. In FESC, identify and then interchange yaw computers No. 1 and No. 2 (Ref. 22-15-01). Close A5 and A23 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (r).

No: Replace (previously identified) yaw computer No. 2 (Ref. 22-15-01).

(r) On CB1, open NO. 1 and NO. 2 NAVIGATION - RADIO ALTM (D4) and (D22) circuit breakers. In mid electrical service center, identify and then interchange radio altimeter RTs No. 1 and No. 2 (Ref. 34-32-01). Close D4 and D22 circuit breakers. Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (s).

No: Replace (previously identified) radio altimeter RT No. 2 (Ref. 34-32-01).

(s) Replace pitch autopilot servo No. 2 high force hook engage solenoid (Hydro A) (Ref. 22-11-07). Engage dual channel AUTOLAND track and then disengage both autopilots as described in Step (c). On CB1, open and then close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Original servo high force engage solenoid is faulted.

No: Replace pitch autopilot servo No. 2 high hook pressure switch (Hydro A) (Ref. 22-11-09). No: Original servo high force engage solenoid is faulted.

---

(74) Fault: Pitch trim wheels do not rotate.

(a) Check trim augmentation system for fault (Ref. 22-18-00).

---

(75) Fault: PITCH TRIM 1 or 2 switchlight indicates FAIL.

(a) Check trim augmentation system for fault (Ref. 22-18-00).

---

(76) Fault: Control columns move.

(a) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. AP engage switch B drops to OFF.

On ramp test set, adjust GS for a 2-dot steer-down indication on Capt HSI. Do control columns move?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

---

(77) Fault: DANA message on CAWP.

(a) Set FD and AP engage switches A and B to OFF. On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Fault causing DANA message display is associated with side 1 (Capt) AFCS. Go to Step (b).

No: Fault causing DANA message display is associated with side 2 (F/O) AFCS. Go to Step (d).

(b) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2. Close A6 and A24 circuit breakers.

Engage dual channel AUTOLAND track mode as described at beginning of Paragraph 5B.

On ramp test set, adjust LOC for a 1/2-dot steer-right indication on Capt HSI. On CAWP, DANA message is displayed. On CB1, open and then close PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Go to Step (c).

No: Replace (previously identified) roll computer No. 1 (Ref. 22-13-01).

(c) Set AP engage switches A and B to OFF. On CB1, open NO. 1 and NO. 2 NAVIGATION - ILS (G4) and (G22) circuit breakers. In FESC, identify and then interchange ILS receivers No. 1 and No. 2 (Ref. 34-33-01). Close G4 and G22 circuit breakers. On ramp test set, adjust LOC for a zero deviation indication on Capt HSI. Engage dual channel AUTOLAND track mode as described at

beginning of Paragraph 5B, and set LOC to 1/2-dot steer-right deviation. On CAWP, DANA message is displayed. On CB1, open PITCH & ROLL (A6) circuit breaker. Is DANA message removed?

Yes: Replace radio altimeter RT No. 1 (Ref. 34-32-01).

No: Replace (previously identified) ILS receiver No. 1 (Ref. 34-33-01).

(d) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breakers. In FESC, identify (No. 1 for side 1, No. 2 for side 2) and then interchange roll computers No. 1 and No. 2. Close A6 and A24 circuit breakers.

Engage dual channel AUTOLAND track mode as described at beginning of Paragraph 5B.

On ramp test set, adjust LOC for a 1/2-dot steer-right indication on Capt HSI. On CAWP, DANA message is displayed. On CB1, open and then close PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Go to Step (e).

No: Replace (previously identified) roll comp. No. 2 (Ref. 22-13-01).

(e) Set AP engage switches A and B to OFF. On CB1, open NO. 1 and NO. 2 NAVIGATION - ILS (G4) and (G22) circuit breakers. In FESC, identify and then interchange ILS receivers No. 1 and No. 2 (Ref. 34-33-01). Close G4 and G22 circuit breakers. On ramp test set, adjust LOC for a zero deviation indication on Capt HSI. Engage dual channel AUTOLAND track mode as described at beginning of Paragraph 5B, and set LOC to 1/2-dot steer-right deviation. On CAWP, DANA message is displayed. On CB1, open PITCH & ROLL (A24) circuit breaker. Is DANA message removed?

Yes: Replace radio altimeter RT No. 2 (Ref. 34-32-01).

No: Replace (previously identified) ILS receiver No. 2 (Ref. 34-33-01).

(78) Fault: AP engage switch A drops to OFF.

(a) Replace roll computer No. 1 (Ref. 22-13-01).

(79) Fault: AP engage switch B drops to OFF.

(a) Replace roll computer No. 2 (Ref. 22-13-01).

(80) Fault: YAW SAS 1 switchlight indicates FAIL

(a) Replace yaw computer No. 1 (Ref. 22-15-01).

(81) Fault: YAW SAS 2 switchlight indicates FAIL

(a) Replace yaw computer No. 2 (Ref. 22-15-01).

(82) Fault: AP engage switches do not drop to OFF

(a) Perform fault isolation procedure 22-10-35 for Fault (7).

(83) Fault: Message not removed from AFCS MODES annunciator

(a) Is message displayed on Capt annunciator?

Yes: Go to Step (b).

No: Go to Step (m).

(b) Is LOC message displayed?

Yes: Go to Step (c).

No: Go to Step (d).

(c) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is message removed?

Yes: Replace roll computer No. 1 (Ref. 22-11-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(d) Is GS message displayed?

Yes: Go to Step (e).

No: Go to Step (f).

(e) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is message removed?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(f) Is A/L message displayed?

Yes: Go to Step (g).

No: Go to Step (h).

(g) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is message removed?

Yes: Replace roll computer No. 1 (Pef. 22-13-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(h) Is ALIGN message displayed?

Yes: Go to Step (i).

No: Go to Step (j).

(i) On CB1, open NO. 1 SYSTEMS - YAW SAS (A5) circuit breaker. Is message removed?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Replace AFCS MODES annunciator (Ref 22-10-05).

(j) Is FLARE message displayed?

Yes: Go to Step (k).

No: Go to Step (1).

(k) On CB1, open NO. 1 SYSTEMS - PITCH & ROLL (A6) circuit breaker. Is message removed?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(l) On CB1, open NO. 1 SYSTEMS - YAW SAS (A5) circuit breaker. Is ROLLOUT message removed?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(m) From Step (a). Is LOC message displayed on F/O annunciator?

Yes: Go to Step (n).

No: Go to Step (o).

(n) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is message removed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(o) Is GS message displayed?

Yes: Go to Step (p).

No: Go to Step (q).

(p) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is message removed?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(q) Is A/L message displayed?

Yes: Go to Step (r).

No: Go to Step (s).

(r) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is message removed?

Yes: Replace roll computer No. 2 (Ref. 22-13-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(s) Is ALIGN message displayed?

Yes: Go to Step (t).

No: Go to Step (u).

(t) On CB1, open NO. 2 SYSTEMS - YAW SAS (A23) circuit breaker. Is message removed?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(u) Is FLARE message displayed?

Yes: Go to Step (v).

No: Go to Step (w).

(v) On CB1, open NO. 2 SYSTEMS - PITCH & ROLL (A24) circuit breaker. Is message removed?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

(w) On CB1, open NO. 2 SYSTEMS - YAW SAS (A23) circuit breaker. Is ROLLOUT message removed?

Yes: Replace yaw computer No. 2 (Ref. 22-15-01).

No: Replace AFCS MODES annunciator (Ref. 22-10-05).

AUTOLAND MODE (PRE-TRACK AND TRACK) - FAULT ISOLATION

1. General

The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for appropriate fault isolation.

Figure 101 and 102 provide component location for Autoland Mode (Pre-Track and Track) troubleshooting.

2. Equipment and Materials

Radio Altimeter Test Set, Collins Radio 980N-1 with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable Assembly.

R NOTE: To preclude possible radio altimeter mutual interference
R problems, use of the 980N-1 Dual Adapter (active) cable,
R with the radio altimeter test set is recommended.

R If the 980N-1 (passive) Adapter Cable is used for
R autoland testing, temporary shielding of the radio
R altimeter antennas may be required for successful
R completion of the test.

R CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED FOR
R SHIELDING MUST BE SUCH THAT REMOVAL BEFORE FLIGHT IS
R GUARANTEED.

VOR/ILS Ramp Test Set T-30, or equivalent.

3. Referenced Procedures

22-12-00	APFDS Modes of Operation - Maintenance Practice
22-02-01	AFCS Lamps and Annunciators - Fault Isolation
22-10-31	FD Basic Mode - Fault Isolation
22-10-33	Autopilot A CWS/CMD Mode - Fault Isolation
22-10-35	Autopilot B CWS/CMD Mode - Fault Isolation
22-13-31	FD Heading Select Mode - Fault Isolation

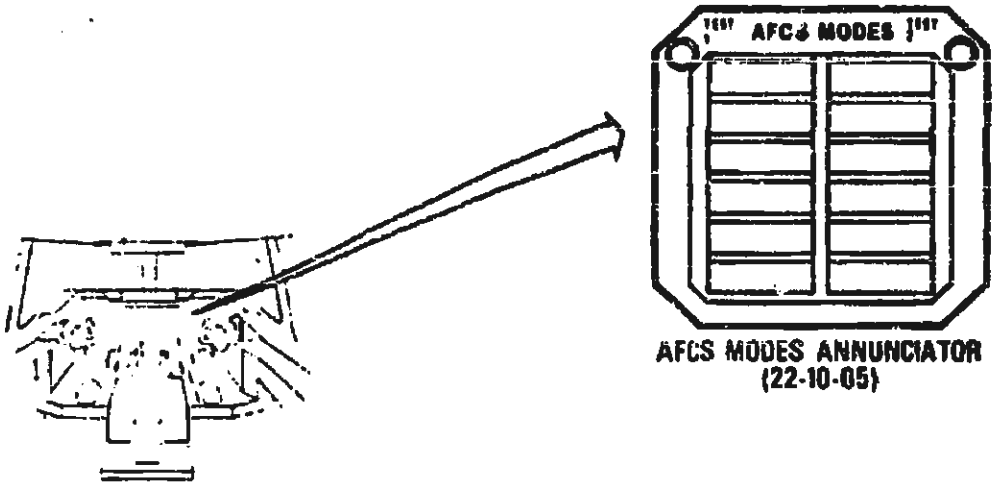
22-14-31 AUTOLAND MODE (TOTAL SEQUENCE) - Fault Isolation

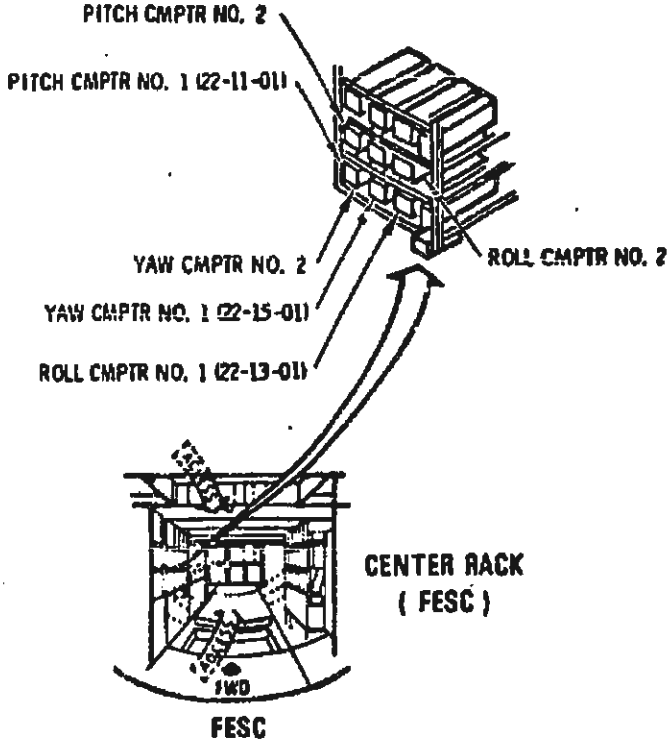
22-14-35 AUTOLAND TRACK MODE - Fault Isolation

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
INDICATOR – AFCS MODE ANNUNCIATOR	2	FLT STA, CAPT AND F/O INSTR PNL	22-10-05

M1-0000-22-2244

Component Location Index
Figure 101





M1-0000-22-2245

Component Locator Diagram
Figure 102

4. Fault Detection Test

A. Preliminary Procedures

(1) Assemble test equipment and establish test condition as described in 22-12-00 - APFDS MODES OF OPERATION - MAINTENANCE PRACTICES.

(2) Perform test specified in 22-14-31, AUTOLAND MODE (TOTAL SEQUENCE) - FAULT ISOLATION.

B. AUTOLAND MODE (PRETRACK AND TRACK) TEST

(1) Connect radio altimeter test set as follows:

(a) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(b) On test set, set TEST SELECT switch to OFF.

(c) In mid-electrical service center, connect test set plug P1 to TEST connector on radio altimeter RT No. 1. Connect test set plug P2 to TEST connector on radio altimeter RT No. 2.

(d) Close D4 and D22 circuit breakers.

(e) Using test set, establish an altitude of 1700 feet as indicated on Capt radio altitude indicator.

RESULT:

On F/O RAI, altitude indication reads 1700 ±170 feet.

(2) Using ILS test set, establish a 1-dot steer down GS indication on Capt HSI.

(3) Using ILS test set, establish a zero LOC deviation indication on Capt HSI.

(4) Set AP engage switch A to CMD.

NOTE: Long-term integration (1 minute or more) of small error signals may result in nuisance fault indications during the following AUTOLAND mode tests. To avoid these nuisance indications, the pace of testing should be steady and even, and long time intervals between successive steps should be avoided.

(5) On NAV MODE panel, depress A/L switchlight to on.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM and A/L ARM messages are displayed.

After a short time interval, LOC ARM messages are replaced by LOC messages.

NOTE: Unless otherwise specified, any display of AP LIMIT messages on AFCS WARNING indicators may be disregarded during the following steps.

(6) Using ILS test set, establish a zero GS deviation indication on Capt HSI.

RESULT:

On both AFCS MODES annunciators, GS ARM messages are replaced by GS messages.

On center console, pitch trim wheels rotate in a direction to produce nose-down trim and then stop. Control columns move slightly forward and then stop. On both ADIs, approach gates come into view and are centered.

NOTE: Unless otherwise specified, it is not necessary to monitor approach gates during the following steps.

(7) Using ILS test set, adjust LOC for approximately 1 bar width steer right indication (left side of bar aligned with right side of course pointer) on Capt HSI.

RESULT:

Control wheels rotate clockwise.

(8) Set AP engage switch B to CMD (hold in position for 5 seconds to insure latch-up).

(9) On radio altimeter test set, adjust altitude for a 1300 feet indication on Capt RAI.

RESULT:

On both AFCS MODES annunciators, A/L ARM messages are replaced by A/L messages, and ALN

ARM and FLR ARM messages are displayed within 30 seconds

On center console, pitch trim wheels rotate in nose-up direction and then stop.

On both RAIs, altitude indications agree to within 130 feet.

On CAWP, DANA message is not displayed.

(10) Using ILS test set, establish a zero LOC deviation indication on Capt HSI.

RESULT:

Control wheels rotate counterclockwise.

(11) On Capt control wheel, depress AP DISC switch.

RESULT:

AP engage switches A and B drop to OFF.

Aural warning sounds.

On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed.

On both AFCS MODES annunciators, all messages are removed.

(12) On radio altimeter test set, adjust altitude for a 1700 feet indication on Capt RAI.

NOTE: Unless otherwise specified, control column and control wheel motion may be disregarded during the following steps.

(13) Set AP engage switch B to CMD.

(14) On NAV MODE panel, depress A/L switchlight to on. Wait until LOC, GS and A/L ARM messages are displayed.

(15) Using ILS test set, adjust LOC for approximately 1 bar-width steer left indication (right side of bar aligned with left side of course pointer) on Capt HSI.

(16) Set AP engage switch A to CMD. Hold in position for 5 seconds to insure latch-up.

(17) On radio altimeter test set, adjust altitude for a 1300 feet indication on Capt RAI. Wait until A/L, ALN ARM and FLR ARM messages are displayed.

RESULT:

On CAWP, DANA message is not displayed.

(18) Using ILS test set, establish a zero LOC deviation on Capt HSI.

(19) Using ILS test set, adjust GS for a 1-dot steer up indication on Capt HSI. Hold for approximately 5 seconds.

RESULT:

On CAWP, DANA message is not displayed.

(20) Using ILS test set, adjust GS for a 1-dot steer down indication on Capt HSI. Maintain the steer down input.

RESULT:

On CAWP, DANA message is not displayed.

(21) Using ILS test set, adjust LOC for a 1 bar-width steer left indication on Capt HSI.

(22) On radio altimeter test set, adjust altitude for a 170 feet indication on Capt RAI.

RESULT:

On CAWP, DANA message is not displayed.

(23) Using ILS test set, adjust LOC for a zero deviation indication on Capt HSI.

(24) On Capt control wheel, depress AP DISC switch to disengage autopilot.

5. Fault Isolation

A. General

Table 101 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 102. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

AUTOLAND Mode (Pre-Track and Track) Fault Isolation Summary
Table 101

TEST REF.	FAULT	FAULT NO.
4B(1)-1	FLAG displayed on radio altimeter indicator.	(1)
4B(1)-2	Radio altitude indicators do not agree to within 170 feet.	(2)
4B(5)-1	On AFCS MODES annunciator, A/L ARM message is not displayed.	(3)
4B(6)	Approach Gate does not come into view.	(4)
4B(9)-2	On AFCS MODES annunciator, FLR ARM message is not displayed.	(6)
4B(9)-3	Radio altimeters indicators do not agree within 130 feet. DANA light displayed during test. Fault isolate as described in 22-12-37,101.	(7)

Schematics for Fault Isolation of A/L Mode (Pre-Track and Track) Problem
Table 102

TITLE	LOCATION
Glideslope Capture, Track Approach Land and Flare Engage Logic Schematic	22-11-00, Schem 15

Schematics for Fault Isolation of A/L Mode (Pre-Track and Track) Problem (Cont)
Table 102

TITLE	LOCATION
A/L, APR, LOC and NAV (VOR) Mode Engage Logic Schematic	22-13-00, Schem 7
A/P DISC, NO DUAL, NO FLARE and CMD DISC Warning Logic Schematic	22-13-00, Schem. 11
YAW SAS ALIGN and Rollout Annunciate Logic Schematic	22-15-00, Schem 6

B. AUTOLAND Mode (Pre-Track and Track) Faults

(1) Fault: Flag is displayed on RAI.

(a) Check for fault in corresponding radio altimeter system (Ref. 34-32-00).

(2) Fault: RAI altitude indications do not agree to within 170 feet.

(a) Perform radio altimeter system SELF TEST (Ref. 34-32-00).

(3) Fault: On AFCS MODES annunciator, A/L ARM message is not displayed.

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed on affected unit with no indicated A/L ARM message fault?

Yes: Replace associated roll computer (Ref. 22-13-01). If problem persists, replace affected AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-10-31).

(4) Fault: Approach gate does not come into view.

(a) Replace pitch computer associated with ADI (Ref. 22-11-01). If problem persists, replace ADI (Ref. 34-21-07).

---

(5) Fault: On AFCS MODES annunciator, ALN ARM message is not displayed.

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed on affected unit with no indicated ALN ARM message fault?

Yes: Replace associated yaw computer (Ref. 22-15-01). If problem persists, replace affected AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(6) Fault: On AFCS MODES annunciator, FLR ARM message is not displayed.

(a) Can mode annunciation press-to-test procedure (Ref. 22-02-01) be performed on affected unit with no indicated FLR ARM message fault?

Yes: Replace associated pitch computer (Ref. 22-11-01). If problem persists, replace affected AFCS MODES annunciator (Ref. 22-10-05).

No: Perform AFCS lamps and annunciators fault isolation procedure (Ref. 22-02-01).

---

(7) Fault: RAI altitude indications do not agree to within 130 feet.

(a) Perform radio altimeter system SELF TEST (Ref. 34-32-00).

AUTOLAND TRACK MODE (ALIGN, FLARE AND ROLLOUT) FAULT ISOLATION

1. General

The fault detection test procedure in Paragraph 4 is used in conjunction with the fault isolation procedure in Paragraph 5. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 5 for appropriate fault isolation.

Figure 101 and 102 provide component location for AUTOLAND Track Mode (Align, Flare and Rollout) troubleshooting.

2. Equipment and Materials

Radio Altimeter Test Set, Collins Radio 980N-1 with G/ITEL No. 34-32-01 Dual Radio Altimeter Cable assembly.

R NOTE: To preclude possible radio altimeter mutual interference
R problems, use of the 980N-1 Dual Adapter (active) cable,
R with the radio altimeter test set is recommended.

R If the 980N-1 (passive) Adapter Cable is used for
R autoland testing, temporary shielding of the radio
R altimeter antennas may be required for successful
R completion of the test.

R CAUTION: IF SHIELDING BECOMES NECESSARY, THE METHOD USED FOR
R SHIELDING MUST BE SUCH THAT REMOVAL BEFORE FLIGHT IS
R GUARANTEED.

R VOR/ILS Ramp Test Set T-30, or equivalent.

3. Referenced Procedures

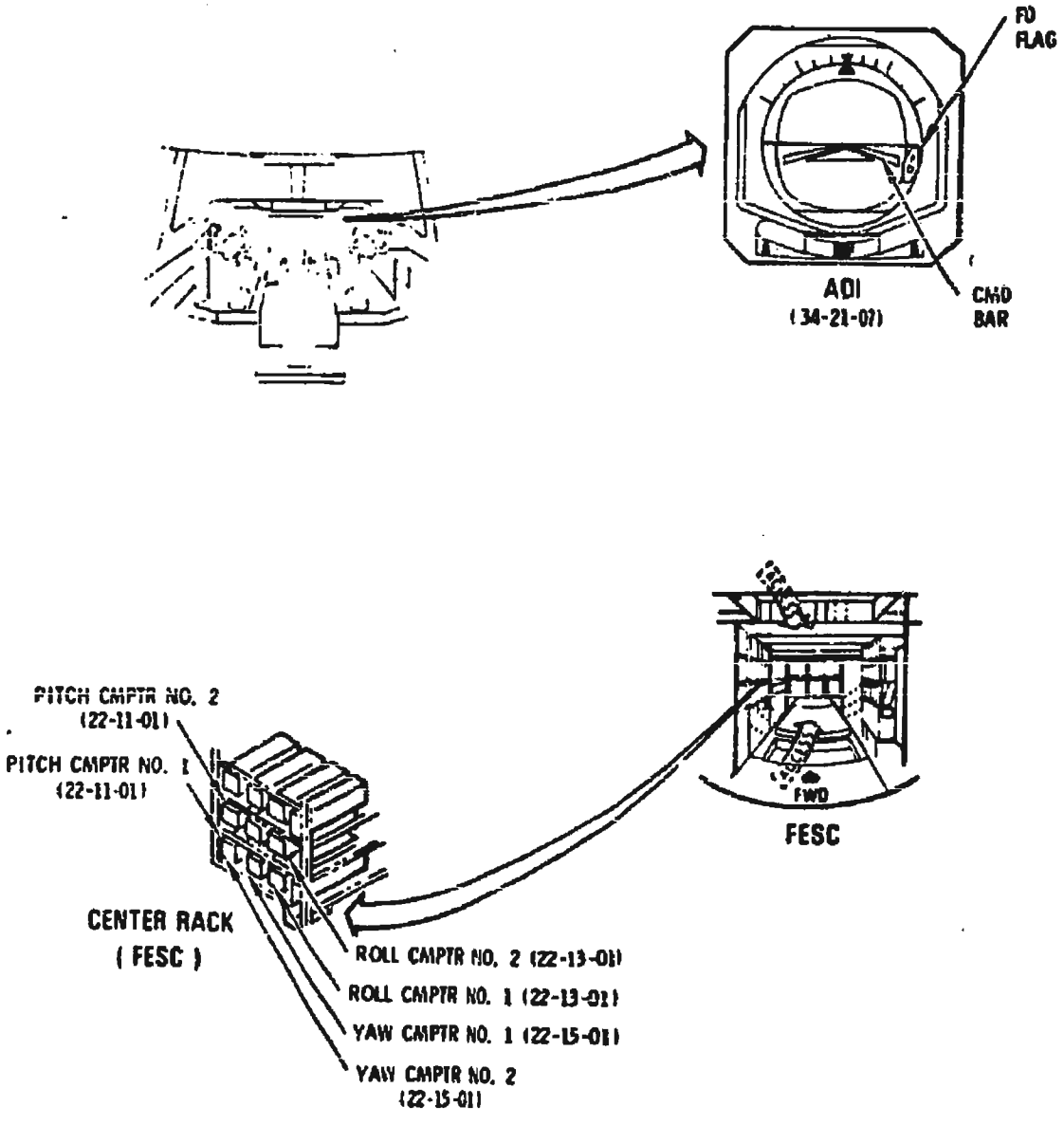
22-12-00	APFDS Modes of Operation - Maintenance Practice
22-14-31	AUTOLAND Mode (Total Sequence) - Fault Isolation
22-14-33	AUTOLAND Mode (Pre-Track and Track) - Fault Isolation
22-12-37	DUAL A/L NOT AVAIL (DANA) - Fault Isolation

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER - PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER - ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER - YAW	2	FESC, CTR RACK/112AB	22-15-01
INDICATOR - ATTITUDE DIRECTOR	2	FLT STA, CAPT AND F/O INSTR PNL	34-21-07

M1-0000-22-2250

R Component Location Index
R Figure 101

R EFFECTIVITY: ALL
R
0018



M1-0000-22-2251

R
R Component Locator Diagram
Figure 102

R EFFECTIVITY: ALL
R
R
001B

R 4. Fault Detection Test

R A. Preliminary Procedures

R (1) Assemble test equipment and establish test conditions
R as described in 22-12-00, APFDS Modes of Operation -
R Maintenance Practices.

R (2) Perform tests specified in 22-14-31, AUTOLAND Mode
R (Total Sequence) - Fault Isolation.

R B. AUTOLAND Mode (Align, Flare and Rollout) Test

R (1) Connect Radio Altimeter Test Set as follows:

R (a) On CB1, open RADIO ALTM (D4) and (D22) circuit
R breakers.

R (b) On test set, set TEST SELECT switch to OFF.

R (c) In mid-electrical service center, connect test set
R plug P1 to TEST connector on radio altimeter RT
R No. 1. Connect test set plug P2 to TEST connector
R on radio altimeter RT No. 2.

R (d) Close D4 and D22 circuit breakers.

R (e) Using test set, establish an altitude of 480 feet
R as indicated on Captains radio altimeter
R indicator.

R RESULT:

R On F/O RAI, altitude indication reads 480 ±10
R feet.

R (2) Reset warning messages on Caution and Warning Panel
R (CAWP).

R (3) On NAV MODE panel, adjust COURSE knobs to establish
R course pointer settings on each HSI 10 degrees less
R than indicated heading.

R (4) ON APFDS ENGAGE panel, set FD A and B switches to ON.

R RESULT:

R On both ADIs, command bars come into view and are
R centered and level.

R (5) Engage dual-channel A/L mode as follows:

R (a) On ramp test set, establish zero LOC and GS beam
R deviation as indicated on Capt HSI.

R (b) Set AP engage switch A to CMD.

R (c) Depress A/L switchlight to on, and immediately set
R AP engage switch B to CMD.

R RESULT:

R On both AFCS MODES annunciators, LOC ARM, GS
R ARM, and A/L ARM messages are displayed.
R After a short time interval, LOC ARM and GS
R ARM messages change to LOC and GS.

R After approximately 35 seconds, A/L ARM
R messages change to A/L, and ALN ARM and FLR
R ARM messages are displayed.

R Pitch trim wheels rotate in nose-up direction
R and stop. Control columns move slightly aft
R and stop.

R On both ADIs, approach gates come into view
R and are centered.

R On AFCS WARNING indicators, NO DUAL and NO
R ALIGN messages are not displayed.

R On CAWP, DUAL A/L NOT AVAIL (DANA) is not
R displayed.

R (6) Reduce the radio altitude to 130 feet as indicated on
R Capt radio altimeter indicator.

R RESULT:

R On both AFCS MODES indicators, ALN ARM message is
R replaced by ALIGN message.

R On both ADI's, the command bars command right roll
R momentarily.

R NOTE: Rudder and Control wheel motion may be
R ignored.

R (7) Disengage the autopilot and set FD A and B switches to
R OFF.

R (8) Reset both course knobs to aircraft heading.

R (9) On APFDS ENGAGE panel, set FD A and B switches to ON.

R (10) Engage dual-channel ALIGN mode as follows:

R (a) Radio altimeters at 130 (±10) feet.

R (b) On ILS test set, turn on LOC and GS POWER switches, and establish zero LOC and GS beam deviation indications on HSI.

R (c) Set AP engage switch A to CMD.

R (d) Depress A/L switchlight to on, and immediately set AP engage switch B to CMD.

R RESULT:

R On both AFCS MODES annunciator LOC ARM, GS ARM, and A/L ARM messages are displayed. After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

R After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN and FLR ARM messages are displayed. The pitch trim wheels rotate in the nose-up direction and stop. The control columns move slightly aft and stop.

R Both ADI approach gates come into view and are centered and level.

R (11) Slowly vary LOC-beam deviation to produce a one-bar width steer right indication on Capt HSI in approximately 5 seconds. (Note: Too rapid a variation of LOC input may result in a DANA fault Wait 5 seconds. Slowly vary LOC-beam deviation to produce a zero indication on Capt HSI. Wait 5 seconds. Repeat above procedure to establish a one-bar width steer left indication for 5 seconds and then establish zero deviation.

R RESULT:

R Both ADI approach gates follow the LOC beam deviation.

R Both ADI command bars respond to LOC beam deviation.

R The control wheels move in response to LOC beam deviation.

R The rudder moves in response to LOC beam deviation.

On CAWP, DANA is not displayed.

(12) Disengage the autopilot and set FD A and B switches to OFF.

(13) On FCES panel, depress ATS 1 and 2 switchlights to on.

RESULT:

ATS 1 and 2 switchlights do not indicate FAIL.

On THRUST panel, ALPHA flag is displayed.

(14) Set all three throttle levers to their approximate mid-range position.

(15) On THRUST panel set ATS engage switch to on.

R NOTE: It may be necessary to restrain the throttle levers from advancing to the maximum thrust position.

(16) On APFDS ENGAGE panel, set FD A and B switches to ON.

(17) Engage dual-channel ALIGN mode as follows:

(a) Using ILS test set, establish zero LOC and GS beam deviation indications on both HSIs.

(b) Set AP engage switch A to CMD.

(c) Depress A/L switchlight to on, and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN and FLR ARM messages are displayed.

The pitch trim wheels rotate in the nose-up direction and stop.

The control columns move slightly aft and stop.

Both ADI approach gates come into view and are centered.

(18) Vary GS-beam deviation to produce a 3/4 dot steer down, then up, deviation as indicated on the HSIs, and then reset the GS-beam for zero deviation.

RESULT:

On both ADIs, COMMAND bar responds to GS-beam deviations.

On both ADI's, approach gates follow the GS-beam deviations.

Control columns move in response to GS-beam deviations.

On CAWP, DANA is not displayed.

(19) Reduce the radio altitude to 40 feet as indicated on Capts radio altimeter indicator.

RESULT:

F/O radio altitude indicator reads 40 (±5) feet. On both AFCS MODES indicators, FLR ARM message is replaced by FLARE.

The throttle levers move aft and stop.

(20) Vary GS-beam deviation to produce a 3/4 dot steer down, then up, deviation as indicated on the HSI's, and then reset the GS-beam for zero deviation.

RESULT:

On both ADIs, the approach gate does not respond to GS-beam deviations.

(21) Install AFCS/MLG accessory unit.

RESULT:

Throttle levers move further aft.

The Auto-Throttle System disengaged.

The control columns move forward and stop.

On AFCS WARNING indicators ATS DISC is not displayed.

(22) Disengage the autopilot and set FD A and B switches to OFF.

(23) Remove AFCS/MLG accessory unit.

(24) REturn radio altitude to 130 feet as indicated on Capts radio altimeter indicator.

(25) On APFDS ENGAGE panel, set FD A and B switches to ON.

(26) Engage dual-channel ALIGN mode as follows:

(a) Radio altimeters at 130 (±10) feet.

(b) Using ILS test set, establish zero LOC and GS beam deviation indications on both HSIs.

(c) Set AP engage switch A to CMD.

(d) Depress A/L switchlight to on, and immediately set AP engage switch B to CMD.

RESULT:

On both AFCS MODES annunciators, LOC ARM, GS ARM, and A/L ARM messages are displayed.

After a short time interval, LOC ARM and GS ARM messages change to LOC and GS.

After approximately 35 seconds, A/L ARM messages change to A/L, and ALIGN and FLR ARM messages are displayed.

The pitch trim wheels rotate in the nose-up direction and stop. The control columns move slightly aft and stop.

Both ADI approach gates come into view and are centered and level.

(27) Smoothly reduce radio altitude from 130 feet to zero feet within a period of 8 to 12 seconds.

RESULT:

On both AFCS MODES annunciators, FLARE and ROLLOUT messages are displayed.

On both ADI's, YAW steering pointer comes into view and is centered.

On both ADIs, approach gate is removed from view.

On both ADIs, the command bars are removed from view.

On CAWP, DANA is not displayed.

(28) Slowly vary LOC-beam deviation to produce a one-bar width steer right indication on Capts HSI in approximately 5 seconds. (Note: Too rapid a variation of LOC input may result in a DANA fault indication.) Wait 5 seconds. Slowly vary LOC-beam deviation to produce a zero indication. Wait 5 seconds. Repeat above procedure to establish a one-bar width steer left indication for 5 seconds and then extablish zero deviation.

RESULT:

Both ADI YAW steering pointers respond to LOC beam deviation.

Control wheels move in response to LOC beam deviations.

Rudder moves in response to LOC beam deviations.

(29) Disengage the autopilot and set FD A and B switches to OFF.

5. Fault Isolation

A. General

Table 101 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 5B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 5B.

Since no fault isolation system can cover every potential fault, reference to applicable maintenance manual schematics are given in Table 102. For fault isolating aircraft wiring, use tables on schematics for a listing of applicable wiring diagram manual.

AUTOLAND Track Mode (Align, Flare and Rollout) Fault Isolation Summary
Table 101

	TEST REF.	FAULT	FAULT NO.
R R	4B(1)	Radio altitude indications do not agree within 10 feet	(1)
R R	4B(5)(c)-1	On AFCS MODES annunciator, A/L ARM not displayed.	(2)
R R	4B(5)(c)-2	On AFCS MODES annunciators ALN ARM message not displayed	(3)
R R	4B(5)(a)-2	On AFCS MODES annunciator, FLR ARM message not displayed.	(4)
R R	4B(5)(c)-4	On ADI, approach gate did not come into view.	(5)
R R	4B(5)(c)-4	On AFCS WARNING indicator, NO DUAL messages is displayed.	(6)
R	4B(5)(c)-5	On CAWP, DANA is displayed.	(7)
R R	4B(1)A	Radio altitude indications do not agree to within 10 feet.	(8)
R R	4B(6)-2	On Capt ADI, YAW steering pointer did not come into view at ROLLOUT.	
R R	4B(6)-2	On F/O ADI, YAW steering pointer did not come into view at ROLLOUT.	(10

R AUTOLAND Track Mode (Align, Flare and Rollout) Fault Isolation
R Summary (Cont)
R Table 101

TEST REF.	FAULT	FAULT NO.
	Not used	(11)
4B(11)-4	On CAWP, DANA is displayed during ALIGN mode, with LOC beam deviation inputs.	(12)
4B(13)	On FCES panel, ATS switchlights indicate FAIL.	(13)
	Not used	(14)
	Not used.	(15)
4B(20)	On Capt ADI, command bar responds to GS-beam deviations during FLARE.	(16)
4B(20)	On F/O ADI, command bar responds to GS-beam deviations during FLARE.	(17)
4B(21)	On AFCS WARNING indicators, ATS DISC message is displayed during FLARE when AFCS/MLG accessory unit is installed.	(18)
4B(27)	On Capt ADI, approach gate did not remove from view at ROLLOUT.	(19)
4B(27)	On F/O ADI, approach gate did not remove from view at ROLLOUT	(20)
4B(22)	On Capt ADI, command bar did not remove from view at ROLLOUT.	(21)
4B(27)	On F/O ADI, command bar did not remove from view at ROLLOUT	(22)
4B(27)	On CAWP, DANA is annunciated when radio altitude is reduced from 130 feet to zero feet in 8 to 12 sec.	(23)

Schematics for Fault Isolation of A/L Mode (Align, Flare and Rollout) Problem
Table 102

TITLE	LOCATION
Glideslope Capture, Track Approach Land and Flare Engage Logic Schematic	22-11-00, Schem 15
A/P DISC, NO DUAL, NO FLARE and CMD DIS Warning Logic Schematic	22-15-00, Schem 11
YAW SAS Align Arm, Align and Rollout Logic Schematic	22-15-00, Schem 6

B. AUTOLAND Track Modes - Align, Flare and Rollout Faults

(1) Fault: RAI altitude indications do not agree to within 10 feet.

(a) Perform radio altimeter system SELF TEST (Ref. 34-32-00).

(2) Fault: On AFCS MODES annunciator, A/L ARM message not displayed.

(a) Perform 22-14-33 fault isolation procedure.

(3) Fault: On AFCS MODES annunciator, ALN ARM message not displayed.

(a) Perform 22-14-33 fault isolation procedure.

(4) Fault: On AFCS MODES annunciator, FLR ARM message not displayed.

(a) Perform 22-14-33 fault isolation procedure.

R

(5) Fault: On ADI, approach gate did not come into view

(a) Perform 22-12-33 fault isolation procedure.

R ----------

(6) Fault: On AFCS WARNING indicator, NO DUAL is displayed.

(a) Perform 22-12-37, 22-14-33 fault isolation procedure.

R ----------

(7) Fault: On CAWP, DANA is displayed.

(a) Perform 22-12-37 fault isolation procedure.

---

(8) Fault: RAI altitude indications do not agree to within 10 feet.

(a) Perform radio altimeter system SELF TEST (Ref. 34-32-00).

---

(9) Fault: On Capt ADI, YAW steering pointer did not come into view at ROLLOUT.

(a) Disengage autopilot channel A and set FDA switch to OFF. On FCES panel, depress YAW SAS 1 switchlight to OFF. On CB1, open NO. 1 SYSTEMS YAW SAS circuit breaker (A5). Replace yaw computer No. 1 (Ref. 22-15-01). Close circuit breaker CB1-A5. Wait one minute, then depress YAW SAS 1 switchlight to ON. Set FDA switch to ON and engage autopilot channel A. Did YAW steering pointer come into view on Capt ADI?

Yes: Original yaw computer was faulty.

No: Fault is either in roll computer No. 1 or Capt ADI. Go to Step (b).

(b) Disengage autopilot channel A and set FDA switch to OFF. On CB1, open No. 1 SYSTEMS PITCH & ROLL circuit breaker (A6). Replace roll computer NO. 1 (Ref. 22-13-01). Close circuit breaker CB1-A6. Set FDA switch to ON and engage autopilot channel A. Did YAW steering pointer come into view on Capt ADI

Yes: Original roll computer was faulty.

No.: Fault is in Capt ADI. Replace Capt ADI (Ref. 34-21-07).

---

(10) Fault: On F/O ADI, YAW steering pointer did not come into view at ROLLOUT.

(a) Disengage autopilot channel B and set FD B switch to OFF. On FCES panel, depress YAW SAS 2 switchlight to OFF. On CB1, open NO. 2 SYSTEMS YAW SAS circuit breaker (A23). Replace yaw computer NO. 2 (Ref. 22-15-01). Close circuit breaker CB1-A23. Wait one minute, then depress YAW SAS 2 switchlight to on. Set FD B switch to ON and engage autopilot channel B. Did YAW steering pointer come into view on F/O ADI?

Yes: Original yaw computer was faulty.

No: Fault is either in roll computer No. 2 or F/O ADI. Go to Step (b).

(b) Disengage autopilot channel B and set FDB switch to OFF. On CB1, open NO. 2 SYSTEMS PITCH & ROLL circuit breaker (A24). Replace roll computer No. 2 (Ref. 22-13-01). Close circuit breaker CB1-A21. Set FD B switch to ON and engage autopilot channel B. Did YAW steering pointer come into view on F/O ADI?

Yes: Original roll computer was faulty.

NO. 1 Fault is in F/O ADI. Replace F/O ADI (Ref. 34-21-07).

---

(11) Not used

---

(12) Fault: On CAWP, DANA is displayed, during ALIGH Mode, with LOC beam deviation inputs.

(a) Perform 22-12-37 fault isolation procedure.

(13) Fault: On FCES panel, ATS switchlight(s) indicate FAIL.

(a) Perform 22-31-00 fault isolation procedure.

(14) Not used.

(15) Not used.

(16) Fault: On Capt ADI, command bar responds to GS-beam deviations during FLARE.

(a) Replace pitch computer No. 1 (Ref. 22-11-01).

(17) Fault: On F/O ADI, command bar responds to GS-beam deviation during FLARE.

(a) Replace pitch computer NO. 2 (Ref. 22-11-01).

(18) Fault: On AFCS WARNING indicators, ATS DISC message is displayed during FLARE when AFCS/MLG accessory unit is installed.

(a) Perform 22-31-00 fault isolation procedure.

(19) Fault: On Capt ADI, approach gate did not remove from view at ROLLOUT.

(a) Replace yaw computer No. 1 (Ref. 22-15-01). If problem persists, replace Capt ADI (Ref. 34-21-07).

(20) Fault: On F/O ADI, approach gate did not remove from view at ROLLOUT.

(a) Replace yaw computer NO. 2 (Ref. 22-15-01). If problem persists, replace F/O ADI (Ref. 34-21-07).

(21) Fault: On Capt ADI, command bar did not remove from view at ROLLOUT.

(a) Replace Capt ADI (Ref. 34-21-07).

(22) Fault: On F/O ADI, command bar did not remove from view at ROLLOUT.

(a) Replace F/O ADI (Ref. 34-21-07).

(23) Fault: On CAWP, DANA is annunciated when radio altitude is reduced from 130 feet to zero feet in 8 to
R 12 seconds.

R (a) Replace pitch computer No. 1 (Ref. 22-11-01). If
R problem persists, replace pitch computer No. 2.

YAW STABILITY AUGMENTATION SYSTEM - DESCRIPTION AND OPERATION

1. General

The yaw stability augmentation system (yaw SAS) automatically stabilizes the aircraft in the yaw axis by controlling the rudder control system. The yaw SAS consists of the basic yaw SAS function which provides yaw damping and turn coordination, and AUTOLAND yaw axis guidance to provide the runway alignment and rollout modes. The yaw SAS is a dual system (yaw SAS 1 and yaw SAS 2) with each consisting of two identical channels. The system is fail-passive with either yaw SAS operating and fail-operative with both yaw SAS operating. The dual system assures positive yaw axis control in the event of a single failure.

The yaw SAS consists of the following components (Ref. Fig. 1):

R Two dual-channel yaw computers, No. 1 and No. 2, mounted on the first and second shelves, respectively, of the center rack in the forward electronic service center (FESC), zone 112

Three identical yaw rate gyros located in the area above galley ceiling, zone 135

Two identical rudder dual-position transducers installed on the vertical stabilizer support assembly next to the No. 3 rudder hinge, zone 324

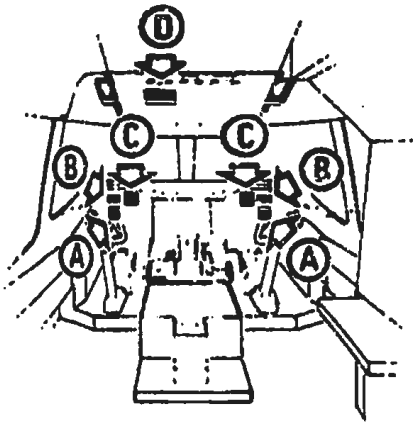
AFCS MODES annunciator indicators (Ref. 22-10-00) located on the pilots instrumenty panels, zones 211 and 212

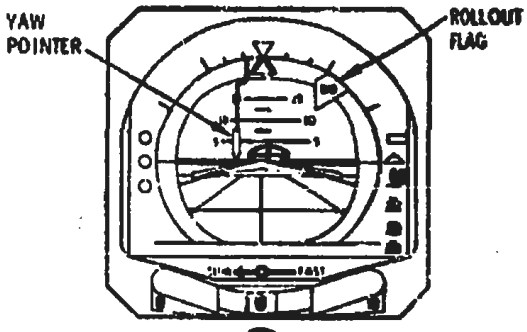
AFCS WARNING indicators (Ref. 22-10-00) located on the pilots instrument panels, zones 211 and 212

FCES control panel (Ref. 22-10-00) located on the pilots overhead panel, zone 210

In addition to the yaw SAS components, the system uses inputs from the roll computers and the left inboard aileron position transducers (Ref. 22-13-00). The FCES computer (Ref. 22-17-00) is used for fault isolation monitoring purposes.

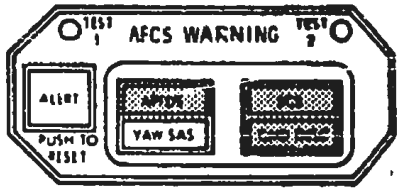
The interface between the yaw SAS components and the associated equipment is shown in Figure 2.





A

ATTITUDE DIRECTOR INDICATOR
(REF. 34-21-00)



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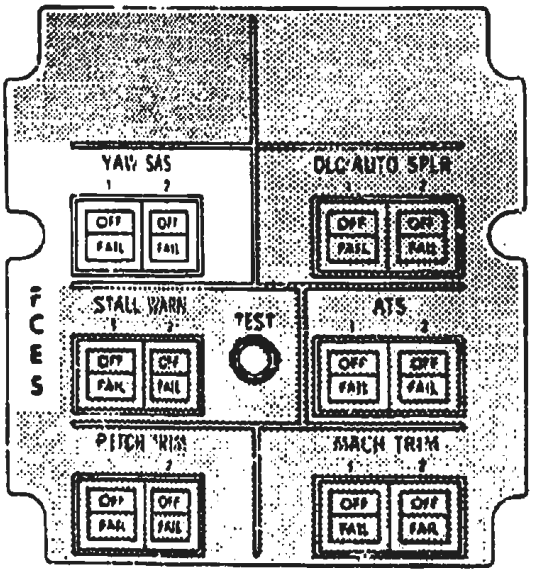
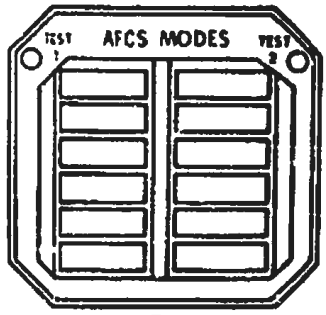
AFCS WARNING INDICATOR



D

FCES CONTROL PANEL

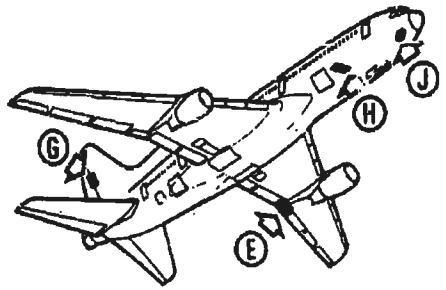


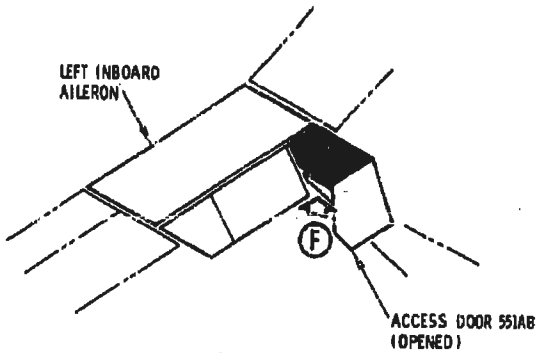
C

AFCS MODES ANNUNCIATOR INDICATOR

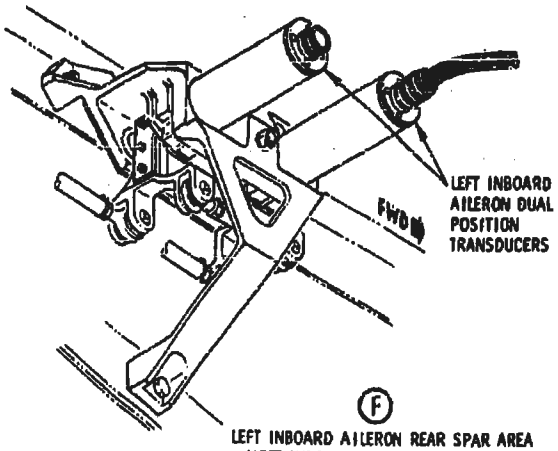
HH 9615
MI-5000-22-027

Yaw SAS Equipment and Location
Figure 1 (Sheet 1)

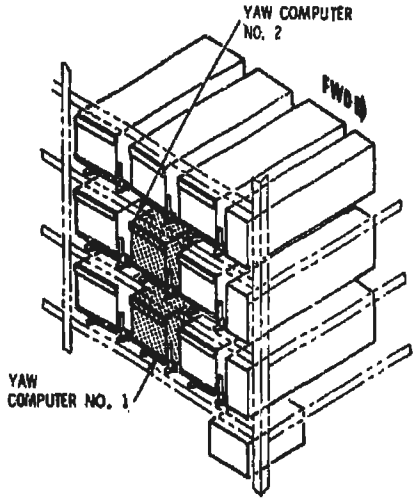




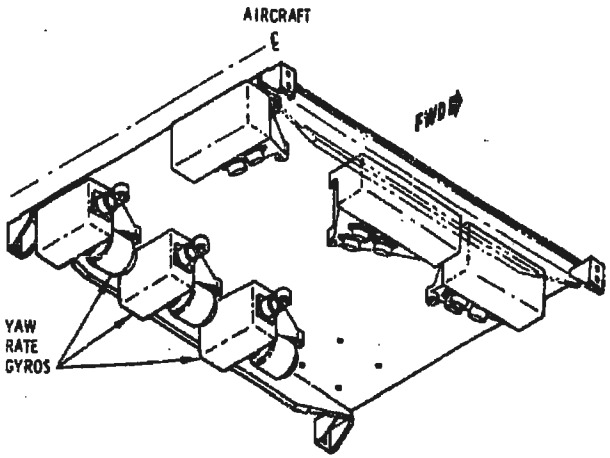
(E)



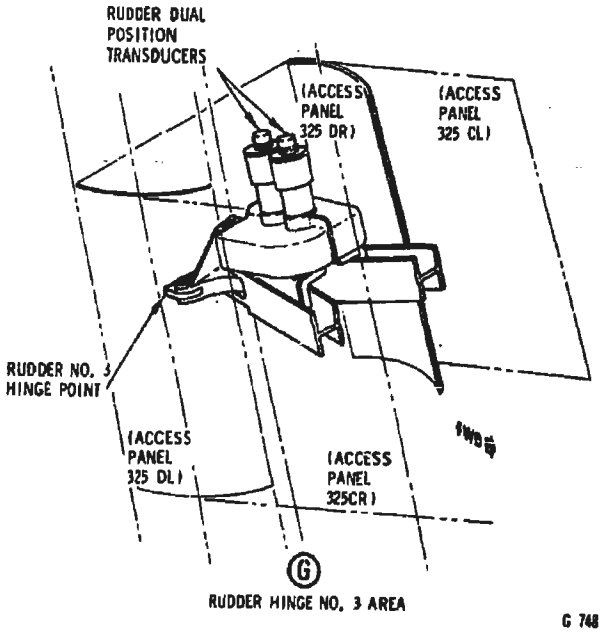
LEFT INBOARD AILERON REAR SPAR AREA
(LEFT INBOARD AILERON STATION 57)



FORWARD ELECTRONIC SERVICE CENTER CENTER RACK



AREA ABOVE GALLEY
(VIEW LOOKING THROUGH GALLEY CEILING)

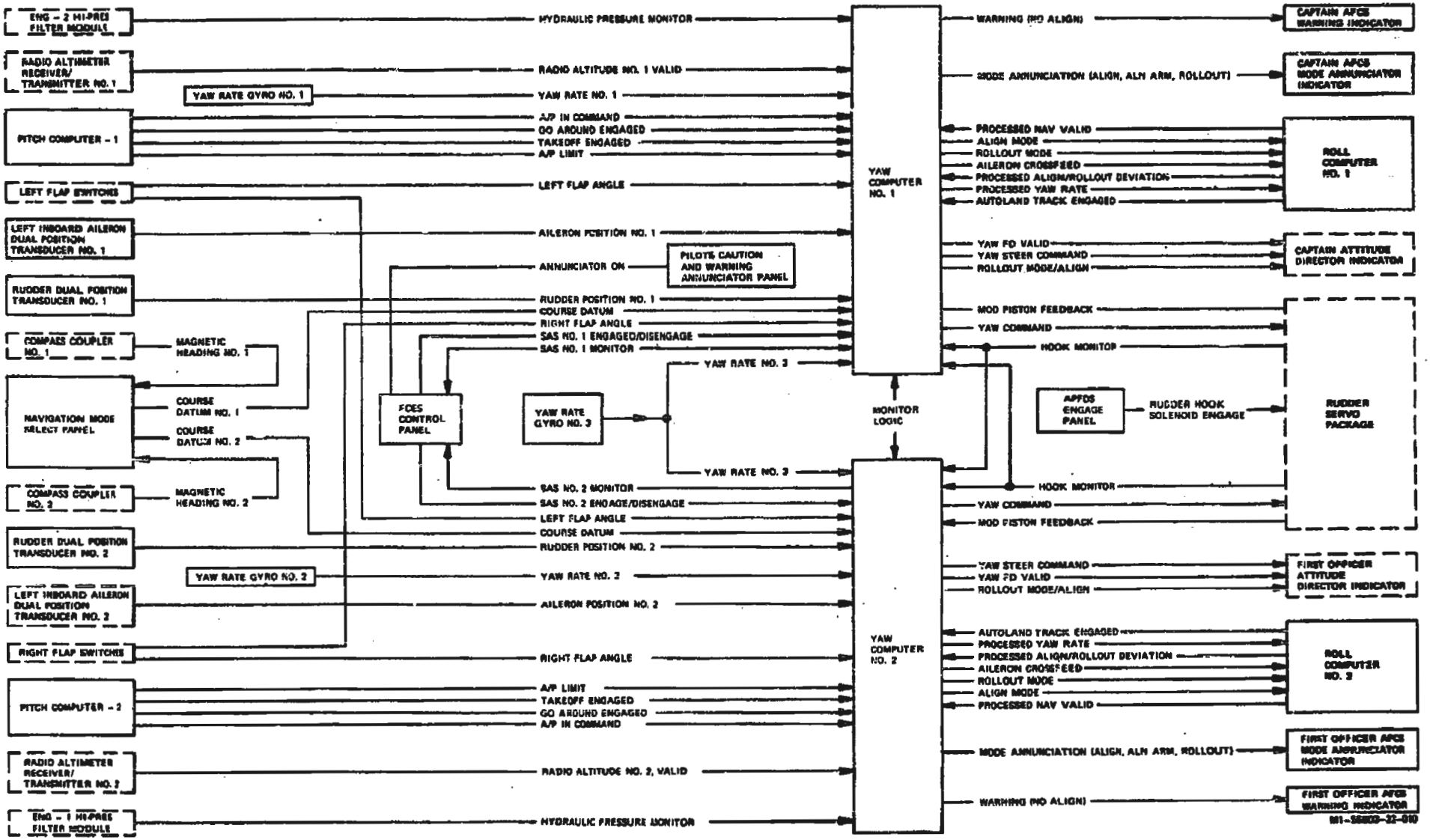


RUDDER HINGE NO. 3 AREA

G 748
MI-5101-22-082

R R Yaw SAS Equipment and Location
Figure 1 (Sheet 2)

R R EFFECTIVITY: ALL
001E



R Yaw SAS Interface Block Diagram
R Figure 2

EFFECTIVITY: ALL

001B

R 2. Operation

R The primary power distribution for the yaw SAS components is
R shown in Figure 3. Figure 4 shows the yaw SAS functional signal
R flow; since the two systems are similar, only system 1 is shown.

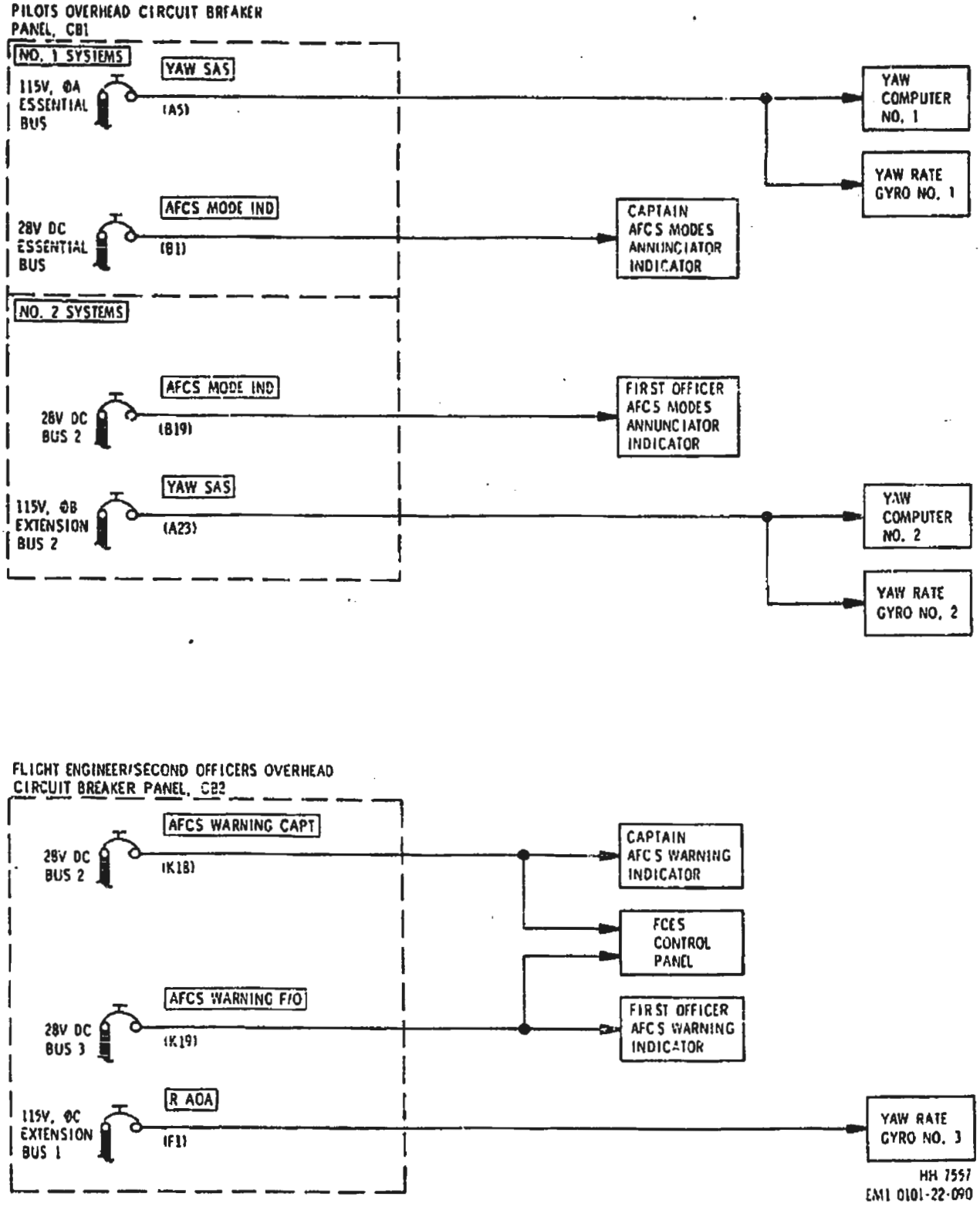
R A. Power Application

R Primary power to the yaw SAS is provided through circuit
R breakers located on the pilots overhead circuit breaker
R panel CB1, zone 210, and the Flight Engineer/Second Officers
R overhead circuit breaker panel CB2, zone 215. The AVIONICS
R FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS (A5) circuit
R breaker supplies 115V, 400 Hz, Phase A essential power to
R yaw computer No. 1 and yaw rate gyro No. 1. The AVIONICS
R FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS (A23)
R circuit breaker supplies 115V, 400 Hz, Phase B extension
R power to yaw computer No. 2 and yaw rate gyro No. 2. The
R power to each yaw computer is processed by the computer
R power supply to provide the required system operating
R voltages. The power to each yaw rate gyro provides gyro
R motor excitation. The two AVIONICS FLIGHT CONTROL SYSTEM -
R AFCS MODE IND circuit breakers (B1 and B19), one on the 28V
R dc essential bus and the other on 28V dc bus 2, supply mode
R annunciator solenoid power to the Captains and First
R Officers AFCS MODES annunciator indicators.

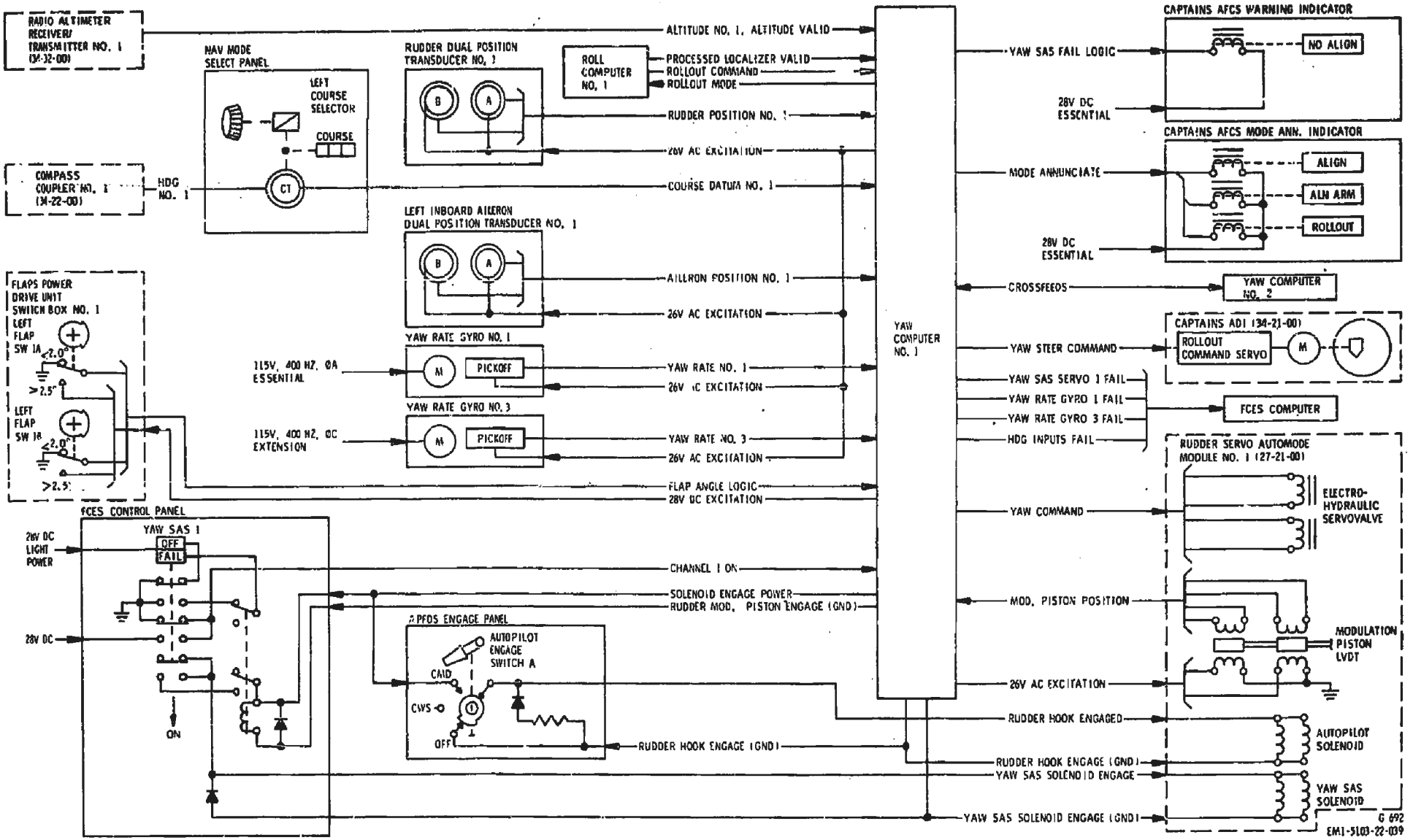
R On the Flight Engineer/Second Officers overhead circuit
R breaker panel, the circuit breakers applicable to the AFCS
R are the FLIGHT STATION MISC - R AOA, (F1) AFCS WARNING -
R CAPT (K18), and AFCS WARNING - F/O (K19). The FLIGHT
R STATION MISC - R AOA (F1) circuit breaker supplies 115V,
R 400Hz, Phase C extension power to yaw rate gyro No. 3 for
R gyro motor excitation. The AFCS WARNING - CAPT (K18) and
R AFCS WARNING - F/O (K19) circuit breakers supply 28V dc
R power to the associated AFCS WARNING indicators as warning
R annunciator solenoid and alert switchlight excitation power.
R The AFCS WARNING circuit breakers also supply power to FCES
R control panel YAW SAS switchlights, through which power is
R applied to the associated yaw computers as yaw SAS channel
R engaging power.

R B. Basic Yaw SAS Function

R The basic yaw SAS provides aircraft yaw damping and turn
R coordination as a function of aircraft yaw rate and roll.
R The yaw damper provides continuous correction of the rudder
R position to compensate for natural aircraft yaw oscillation
R (Dutch roll). The turn coordination provides aircraft
R response improvement during turns. The basic yaw SAS
R operates over the entire flight profile. The basic yaw SAS



R R Yaw SAS Primary Power Distribution Diagram
Figure 3



Yaw SAS Functional Block Diagram
Figure 4

can operate independently of the autopilot flight director system.

R In the basic yaw SAS operation, until the AUTOLAND mode is initiated, the dual rudder servo (Ref. 27-21-00) operates in a series configuration. The series servo operation allows manual inputs from the rudder pedals to be summed with the yaw SAS command signals. The rudder deflection limit is ±10 degrees during series servo operation.

(1) Yaw SAS Engagement

With the YAW SAS switchlights on the FCES control panel engaged, the yaw SAS function is activated when electrical and hydraulic power are applied to the aircraft. The yaw SAS function can be in a fail-passive (single system) or fail-operational (dual system) configuration at the pilots discretion
R throughout the flight profile until the AUTOLAND function is initiated. With both systems initially engaged, one of the systems can be turned off through the associated switchlight on the FCES control panel. When either switchlight is engaged, a channel-on signal is provided to the engage logic of the associated yaw computer.

The yaw SAS solenoid in the rudder servo automode module is energized when the yaw SAS is engaged. The solenoid engage power is supplied by the yaw computer through relay and switchlight contacts. The solenoid enables the electrohydraulic transfer valve which controls the modulation piston in response to the yaw SAS command signals.

(2) Yaw Damper/Turn Coordination

Yaw damping (Ref. Fig. 5) is provided by the yaw computer as a function of aircraft yaw rate supplied by the yaw rate gyro. The computational channels of yaw computer No. 1 receive yaw rate signals from yaw rate gyros No. 1 and No. 3. Yaw computer No. 2 receives yaw rate signals from yaw rate gyros No. 2 and No. 3. The yaw rate signal is demodulated, filtered, and applied to a gain-change device. The gain of the signal is increased when a logic signal representing a flap angle greater than 4 degrees is received from the flap switch. The gain is attenuated when a logic signal representing a flap angle less than 4 degrees is received from the flap switch. The signal is filtered and becomes the rudder command output signal.

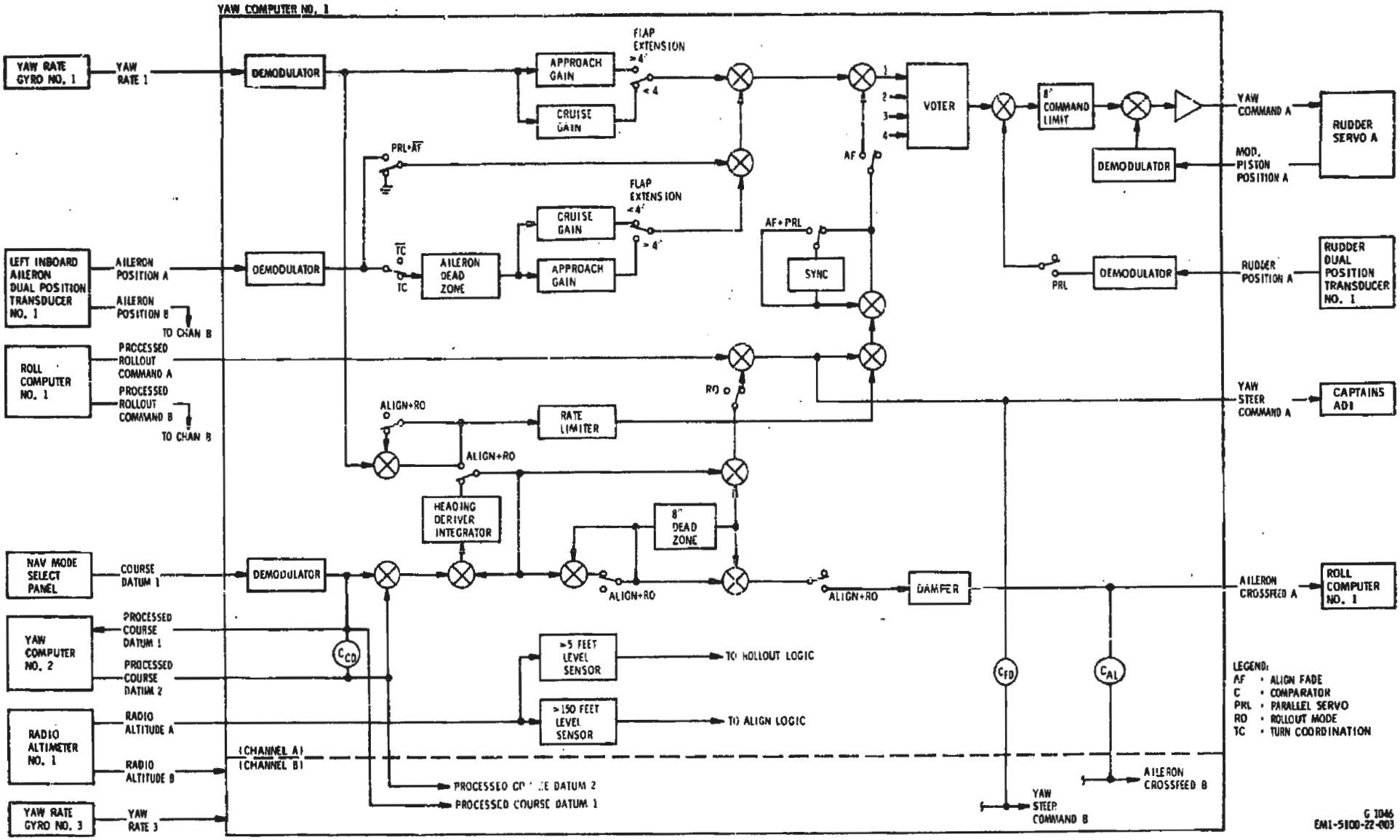
Turn coordination (Ref. Fig. 5) is performed by processing the aileron position signal from the left inboard aileron position transducer. The signal is demodulated, filtered, and applied to a gain changer. The signal is inhibited when the autopilot is in a command configuration and the yaw SAS is in the alignment or rollout mode. The signal is amplified when the flap angle is greater than 4 degrees. The signal is filtered and summed with the yaw damping signal to produce rudder command signals.

The rudder command signals from the four channels (two in each computer) are crossfed to the two quad voters in each computer. The quad voters select the most desirable rudder command signal from the inputs. Before entering the voters, the rudder command signals are monitored by cross-channel comparators provided at the voter input. The comparators detect any faulty channel and cause the voter switching logic to eliminate that channel from the voter input. The voters select a signal from the remaining command signal inputs.

The voted rudder command signals from both voters are limited, and then summed with the rudder modulation piston position feedback signals from the corresponding rudder servo automode module. The resultant signals are applied to the rate limiters and to a comparator. The comparator monitors the modulation piston feedback signals. If one signal is not compatible with the other signal, or if the signal is not present, the corresponding rudder servo automode module is automatically disengaged. The command outputs from the rate limiters are amplified and applied to the rudder servo automode module transfer valve coils. The transfer valve controls the hydraulic pressure to the rudder actuators in response to the rudder command signals. The transfer valve coils are monitored by a comparator in the associated computer. The comparator will detect an open coil or any incompatible command signals and automatically disengage the rudder servo.

R C. AUTOLAND Yaw Guidance Function

R The AUTOLAND function of the yaw SAS consists of the runway alignment and rollout modes. The runway alignment mode provides yaw commands to the rudder servo for a forward slip maneuver. The rollout mode provides runway centerline tracking after touchdown until the aircraft speed is reduced
R to taxiing speed. During AUTOLAND, the yaw command signals applied to the rudder servo are a combination of the runway



Yaw SAS Data Flow
Figure 5

EFFECTIVITY: ALL

alignment or rollout computation and the basic yaw SAS computation.

R During AUTOLAND, the rudder servo operates in a parallel servo configuration, which increases the rudder deflection limit to ±30 degrees required for landing. In the parallel servo configuration, the rudder pedal inputs are inhibited, and the computed command takes complete control of the rudder servo. The rudder pedals are displaced in response to the computed commands. The automatic command can be overridden to gain manual control by applying an overriding force on the rudder pedal.

R (1) AUTOLAND Engagement

The yaw SAS and the autopilot flight director system
R are normally in fail-operational status during the
R AUTOLAND configuration. If one yaw SAS has been disengaged during cruise, it must be reengaged to achieve fail-operational status.

When the A/L mode is selected on the NAV MODE select panel and the autopilot engage switches on the APFDS ENGAGE panel are placed in the CMD position, the yaw SAS is ready for engagement. Solenoid engage power from each yaw computer is applied to the autopilot solenoid in the associated rudder servo automode module. The solenoid does not energize until the
R autopilot achieves AUTOLAND (A/L) track.

When A/L tracking is achieved, each yaw computer receives an A/L track signal from the associated roll computer. The signal causes the yaw computer to provide the rudder hook engage signal to energize the associated rudder servo autopilot solenoid. The solenoid engages the rudder hook, which results in parallel rudder servo operation. The rudder hook engages with either or both yaw SAS operational. When rudder hook engagement is achieved, the AFCS MODES annunciator indicators display the ALN ARM mode message.

(2) Runway Alignment

The alignment mode (Ref. Fig. 5) is engaged at an altitude of 150 feet, as sensed by the radio altimeter. At engagement, the AFCS MODES annunciator indicators switch from ALN ARM to the ALIGN mode display. The alignment mode is a heading/heading-rate maneuver. Damping is provided by mixing heading and heading rate signals with a processed yaw rate signal from the basic yaw SAS circuits.

Four heading reference signals are required in the alignment computations, but only two course datum inputs are provided. Integrators are used to generate synthetic heading reference signals from the yaw rate. The course datum inputs are used to initially condition the integrators before the alignment maneuver begins. After the alignment maneuver has begun, only the yaw rate signal is used. The derived heading is applied to a decrab limiter and a heading memory synchronizer to compute the forward slip signal.

For high crosswinds, runway alignment is achieved by dropping the wing slightly while further compensation is produced by landing at a crabbed angle. To lower the wing, an aileron crossfeed signal from the decrab limiter and heading memory synchronizer is applied to the roll computer. The signal provides the roll computer with advance notice of an aileron command requirement. The signal is proportional to the initial aircraft crab angle.

The decrab heading memory signal is summed with the memorized heading signal to generate the runway alignment computations. The computations are mixed with the processed rollout command signal from the roll computer. The rollout command is a combination of the localizer deviation signal and the lateral acceleration signal. The resultant output is the rudder command signal. The rudder command signal is also summed with the yaw damping signals provided by the basic yaw SAS and applied to the voters as one of the rudder command signals. The rudder command signals are processed through the comparators, voters, and servoloops, and then applied to the rudder servo in the same manner as the basic yaw SAS.

(3) Rollout

The rollout mode (Ref. Fig. 5) is engaged when the yaw computer level sensor detects the altitude signal of 5 feet from the radio altimeter. The AFCS MODES annunciator indicators display the ROLLOUT mode message. The alignment mode computations are automatically switched off, except for the processed rollout command signal from the roll computers. The processed rollout command signal is used as the rudder command signal.

The rollout command bar appears on the attitude director indicators (ADI) just prior to touchdown. The rollout command bar is driven into view by the rollout-enable signal. The rollout command bar

provides computed rollout guidance. A R/O flag appears on the ADI and the rollout command pointer is biased out of view when a yaw command logic malfunction has occurred.

R (4) Series and Parallel Modes

R Yaw SAS input controls the rudder with no feedback to
R the rudder pedals in series servo mode, and supplies
R feedback to the rudder panels in parallel servo mode
R through engagement of the rudder hook. The servo is
R switched into parallel mode at ALTRK or Go-Around with
R the Autopilot in CMD. During parallel mode, a force of
R 85-110 pounds is required on the rudder pedals to
R override the yaw SAS input.

D. System Status

The status of yaw SAS operation is reflected by the rudder servo modulating pistons. The engagement of a modulating piston requires associated yaw SAS engagement, an operational rudder servo, valid navigational and sensor inputs, and valid yaw computations. Any inability to fulfill the requirements causes modulating piston disengagement, which results in annunciation of the FAIL message on the associated YAW SAS switchlight on the FCES control panel.

During the AUTOLAND mode, inability of the yaw SAS to perform runway alignment and rollout maneuvers causes the AFCS WARNING indicators to display the NO ALIGN warning, which indicates that the rudder servo hook assembly is not engaged. Once the rudder hook has engaged, any yaw SAS failure causes disengagement of the corresponding rudder servo modulating piston and forces the corresponding autopilot flight director system (APFDS) to disengage.

The APFDS requires the engagement of at least one yaw SAS. In the event of total yaw SAS disconnection, the entire APFDS disengages and the AP DISC warning on the AFCS WARNING indicators comes on.

E. Fault Isolation Monitoring

A fault isolation monitor (FIM) is included in the yaw computers for ground maintenance. The FIM isolates a failure to the input, the computer, or to the output of the system. A computer failure is indicated by the FIM annunciator on the computer front panel. In addition to the computer failure, the FIM isolates a failure to a yaw rate gyro or a rudder servo automode module. The FIM sends a signal to trip the associated FIM annunciator provided on

the FCES computer (Ref. 22-17-00). The FIM in yaw computer No. 1 monitors yaw rate gyros No. 1 and No. 3 and rudder servo automode module No. 1, and trips the YAW RATE GYRO 1, YAW RATE GYRO 3, and YAW SAS SERVO 1 annunciators on the FCES computer front panel. The yaw computer No. 2 FIM monitors yaw rate gyro No. 2 and rudder servo automode module No. 2, and trips the YAW RATE GYRO 2 and YAW SAS SERVO 2 annunciators on the FCES computer front panel.

3. Yaw Computer

A. Description

The yaw computer is housed in a 3/4 ATR case. The front panel contains a fault isolation monitor annunciator, and a carrying handle. Mounting hooks are provided to secure the case to a rack. Two dual electrical connectors are provided on the rear of the case for system interface.

The case houses a chassis on which the modules are either mounted or plugged in. The boards plug into a side plane interconnect from the right side (with respect to unit front) of the chassis. The chassis consists of the following plug-in module boards: seven computation modules, three logic modules, one logic computation module, and two power supply modules. Two power transformers are mounted on the rear of the chassis.

4. Yaw Rate Gyro

A. Description and Operation

The yaw rate gyro is comprised of cylindrical and rectangular housings mounted on a bracket. The cylinder houses the gyro and the pickoff. The rectangular housing contains a self-test circuit, wiring, and electrical connector. The gyro is mounted with the line-of-flight arrow marked on the unit pointing forward.

The gyro motor is excited by 115V, 400 Hz power, and the pickoff is excited by 26V, 400 Hz power. The gyro runup time is a maximum of 25 seconds and the rundown time is a maximum of 3 minutes. The gyro pickoff produces the yaw rate output signal. An aircraft nose-left yaw causes the pickoff to produce a yaw rate output signal that is in phase with the pickoff excitation voltage.

5. Rudder Dual Position Transducer

A. Description and Operation

The rudder dual position transducer is a dual synchro transmitter which senses rudder position and converts the sensed rudder position to proportional dual synchro signals which are used as feedbacks. The transducer is comprised of two independent synchros with a common rotor shaft and an electrical receptacle. The exposed portion of the rotor shaft is serrated and grooved for installation purposes. The transducer housing at the rotor shaft end is circumferentially grooved for mounting purposes. Electrical zero (EZ) index marks are provided on the housing and rotor shaft for installation alignment purposes.

Rudder movement rotates the transducer rotor shaft. Angular displacement of the rotor shaft is proportional to rudder position, and the direction of shaft rotation depends on the direction of rudder deflection. As the transducer rotor shaft is displaced from electrical zero (zero rudder deflection), the displacement is induced on the stator of the two synchros as electrical outputs. The outputs are in phase and at an amplitude of 200 millivolts ac per degree of rudder deflection. The signals are positive for left rudder deflection and negative for right rudder deflection. The transducer synchros are excited by the 26V ac, 400 Hz power.

R 6. Engine Hydraulic Pump Pressure Switch

A. Description and Operation

There are two engine hydraulic pump pressure switches. One switch is located on engine No. 1 and the other switch on engine No. 2. Each switch has two functions as follows:

(1) The primary function of each switch is to illuminate the PUMP OUTLET "LO PR" light on the flight engineers HYDRAULIC panel when the engine hydraulic pump pressure is below 700 psi.

(2) The other switch function is to automatically reset the YAW SAS FAIL lights when the engines are started. When the hydraulic pump pressure in engine No. 1 is above 700 psi, YAW SAS 2 FAIL light is reset automatically (dark indication). Engine No. 2 automatically resets YAW SAS 1 FAIL light. Either YAW SAS FAIL light can be reset manually after engine start.

YAW STABILITY AUGMENTATION SYSTEM - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting yaw SAS faults are included in this section of the manual. A malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use Yaw SAS fault matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the yaw SAS fault isolation diagrams and schematics. Figure 101 and 102 provide component location for yaw SAS troubleshooting.

A. General

Yaw SAS system fault isolation contains two levels of troubleshooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation troubleshoots a specific yaw SAS system problem. System oriented fault
R isolation tests and troubleshoots the yaw SAS system by a
R systematic procedure and is included in adjustment and test (Ref. 22-15-00).

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the yaw SAS system by a specific fault number. It also identifies the LRU which can cause the problem. For faults not listed in Figure 103, perform Adjustment/Test procedure (Ref. 22-15-00, Page 501) to isolate problem.

Figure 104 provides diagnostic steps to further isolate the fault. The diagnostic steps are in a flow chart form which contains complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the actions are outside the blocks. When using the flow charts, it is assumed that systems are in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

R Fault Isolation Diagram and Schematic List
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Yaw SAS System Fault Matrix
104	Yaw SAS System Faults
SCHEM 1	Yaw SAS Block Diagram
SCHEM 2	Yaw SAS Power Distribution Schematic
SCHEM 3	Yaw SAS Basic Mode Signal Flow Schematic
SCHEM 4	Yaw SAS Runway Align and Rollout Signal Flow Schematic
SCHEM 5	Yaw SAS Engage Logic Schematic
SCHEM 6	Yaw SAS Align Arm, Align, and Rollout Logic Schematic
SCHEM 7	Yaw SAS FD Valid, No Align, Yaw CAT III Avail, and Yaw No First Fail Logic Schematic
SCHEM 8	Yaw SAS Flap Position Logic Schematic
SCHEM 9	Yaw SAS FIM Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – YAW	2	FESC, CTR RACK/112AB	22-15-01
CONTROL BOX – INDICATOR LIGHTS			
CARD 1A5	1	FESC, AFT OF ELEC RACK/112AB	33-17-04
CARD 1A13	1	FESC, AFT OF ELEC RACK/112AB	33-17-04
EHV – YAW SAS 1 (2) HYD SYS B (A)	2	VERT STAB, ON RUDDER SERVO MDL/324AL, 324AR	27-21-09
GYRO – YAW RATE	3	GALLEY CEILING/135DB	22-15-02
LIGHT – RECTANGULAR INDICATOR	2	FLT STA	20-33-04
MODULE – RUDDER SERVO	1	VERT STAB/324AL, 324AR	27-21-07
PANEL – FCES CONTROL	1	FLT STA/PILOT OVHD PNL	22-10-07
SWITCH – AP A (B) HYD SYS B (A) PRESSURE	2	VERT STAB, ON RUDDER SERVO MDL/324AR	27-21-24
SWITCH – HYDRAULIC SYSTEM LOW PRESSURE			
HYD A (2932-S21)	1	ENG 1 PYLON/453DR	29-32-01
HYD B (2932-S23)	1	AFTERBODY/471BL	29-32-01
SWITCHBOX – FLAP PDU	2	HSC, ON FLAP PDU/147AB	27-51-12
TRANSDUCER – LEFT INBOARD AILERON DUAL POSITION	2	L WING/551AB	22-13-03
TRANSDUCER – RUDDER DUAL POSITION	2	VERT STAB/324CL, 325DL	22-15-03
VALVE – AP A (B) HYD SYS B (A) SHUTOFF	2	VERT STAB, ON RUD SERVO MDL/324AL, 324AR	27-21-08
VALVE – DIFFERENTIAL PRESSURE SENSING HYDRAULIC FUSING CHECK	1	AFTERBODY/317BB	29-11-75
VALVE – MOTOR OPERATED HYDRAULIC FUSING SHUTOFF	1	AFTERBODY/317BB	29-11-74
VALVE – YAW SAS 1 (2) HYDRAULIC SYSTEM B (A) SHUTOFF	2	VERT STAB, ON RUDDER SERVO MDL/324AL, 324AR	27-21-08

M1-0001-22-2164

R
R

Component Location Index
Figure 101

EFFECTIVITY: ALL

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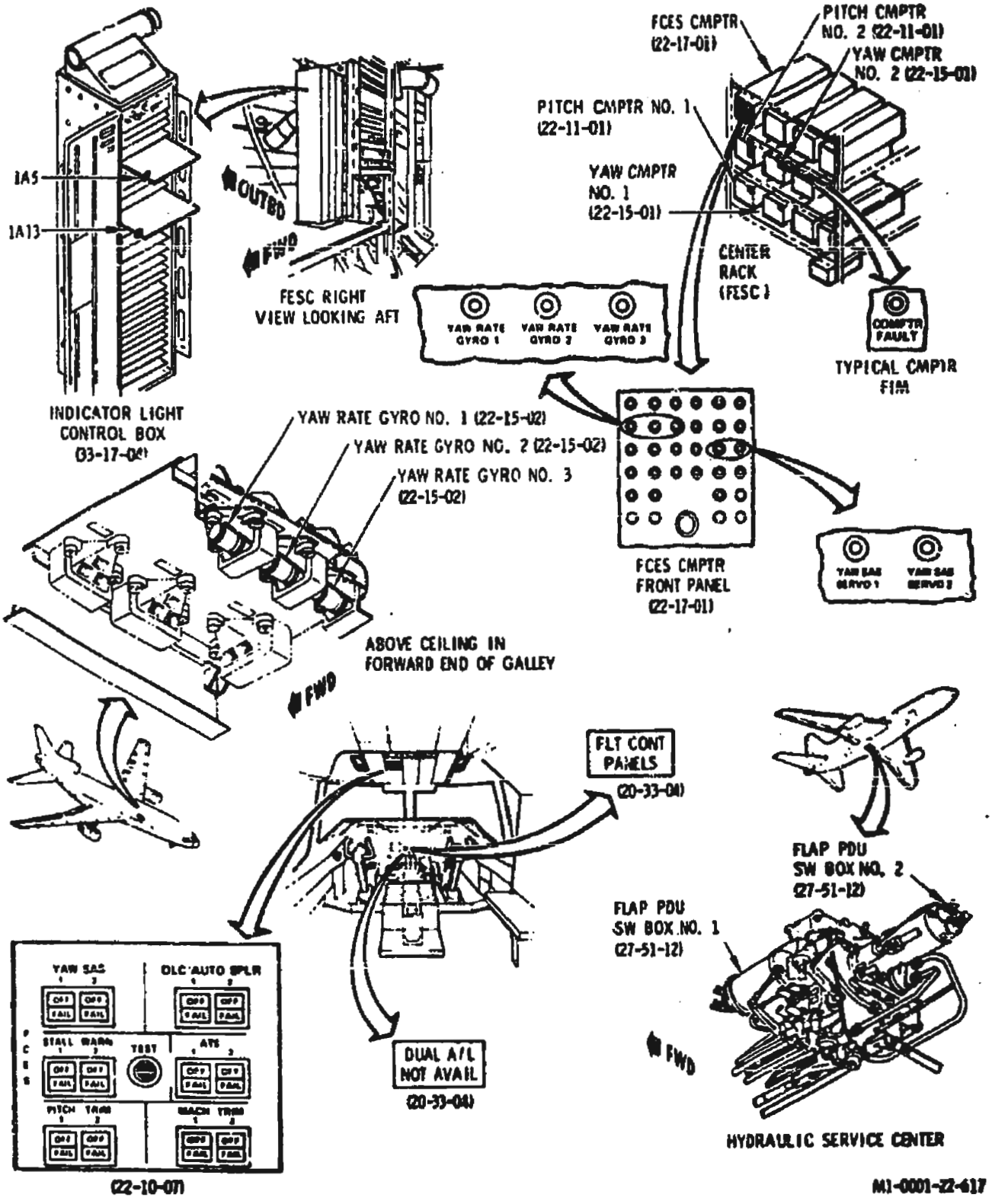

R Component Locator Diagram
R Figure 102 (Sheet 1)

EFFECTIVITY: ALL

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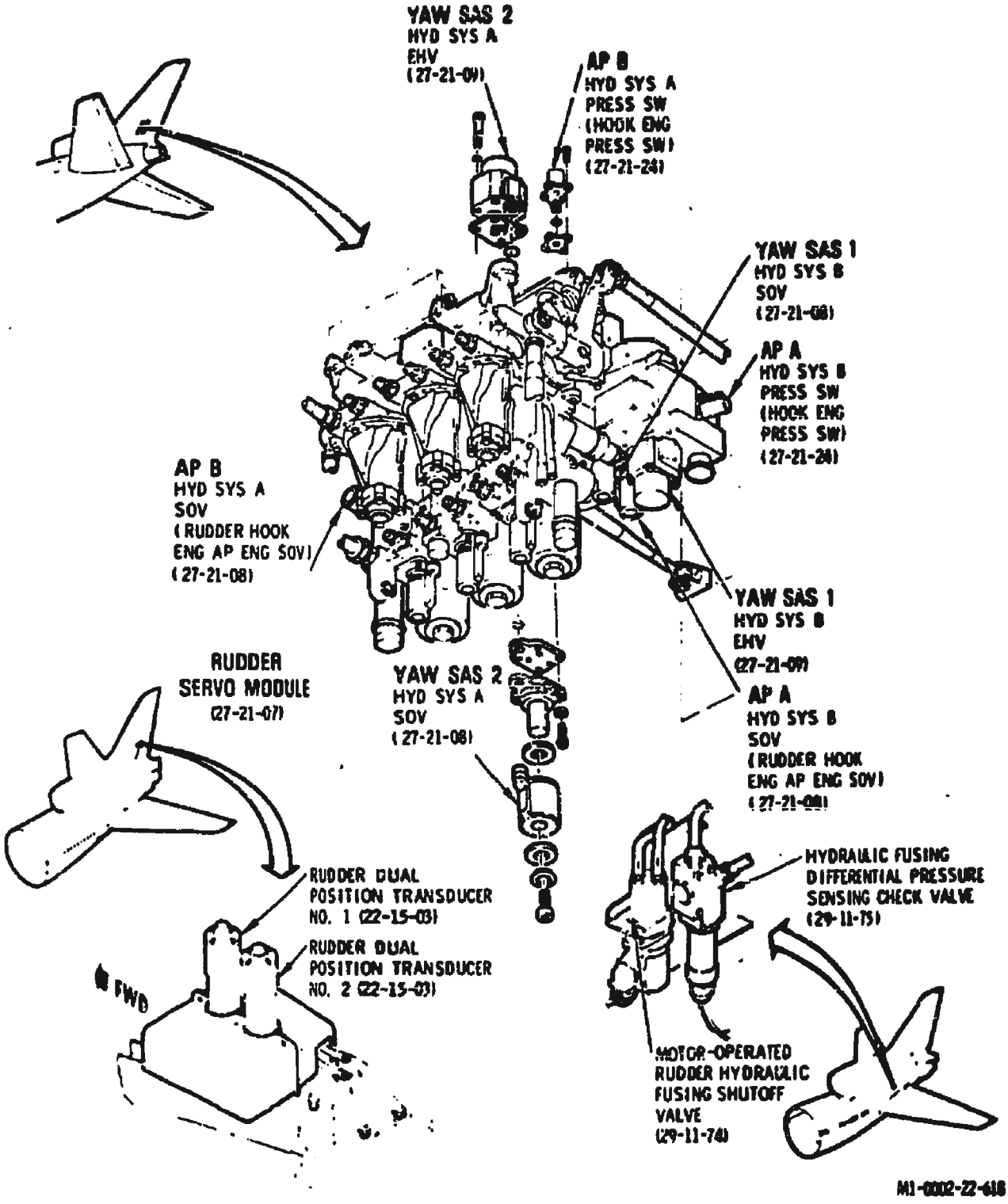

R
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Component Locator Diagram
Figure 102 (Sheet 2)

EFFECTIVITY: ALL

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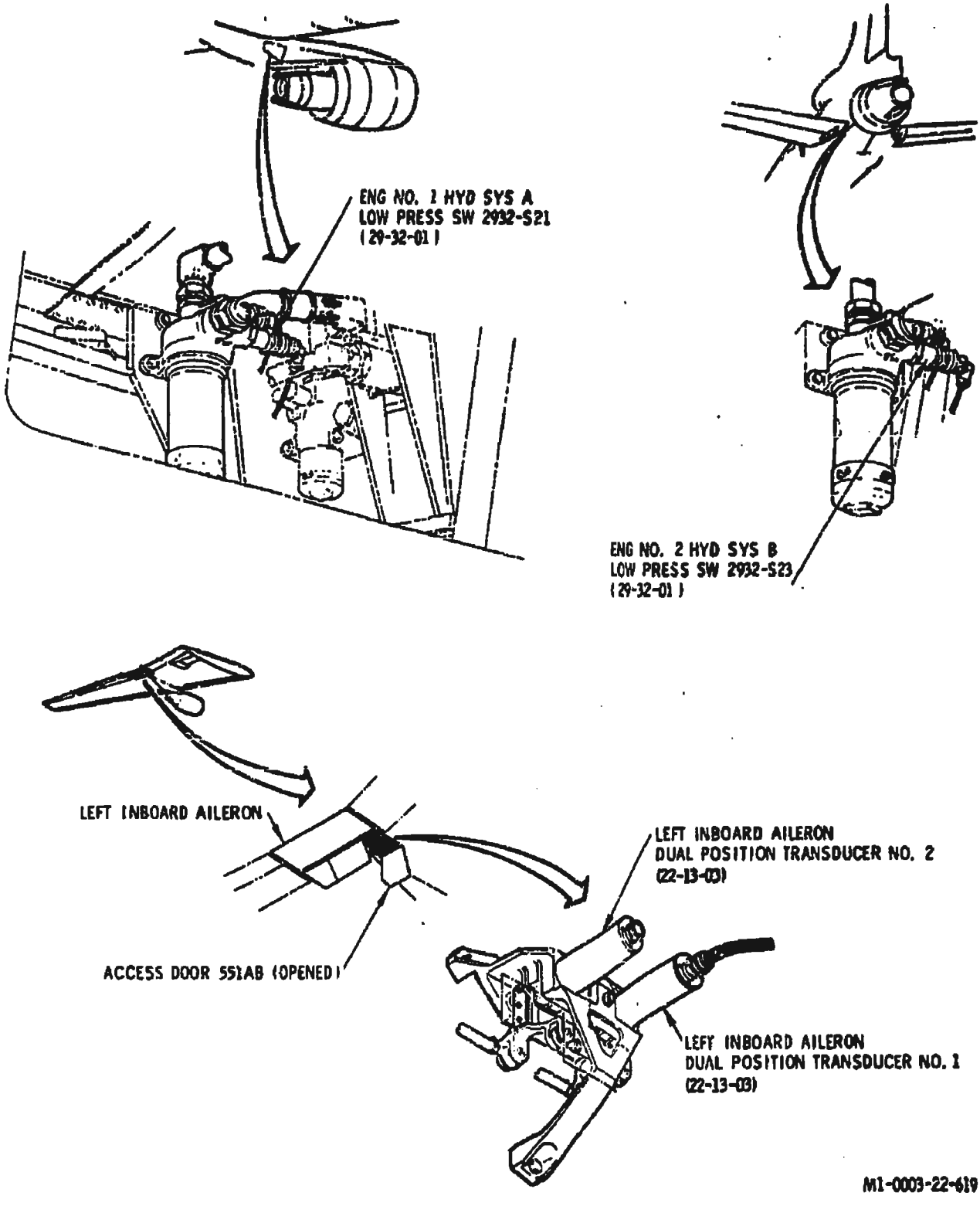


R Component Locator Diagram
R Figure 102 (Sheet 3)

EFFECTIVITY: ALL

FAULTS		FIM						NO FIM											
		Troubleshooting Faulty LRU																	
		Check FIM on LRU or on Front Panel of FCES cmptr						Continuity Check or Replace or Reset Rudder Fuse											
No.	Problem	YC	YRG	SGV	EHV	RUD SVO	PC	RUD FUSE	FLAP PDU SB	ALL POSN XDCR	RUD POSN XDCR	FCES CP	AP PRESS SW	ENG PRESS SW	ILCB CARD	RUD FUSE SOV	FUSE ΔP CV	RUD SOV
1	Yaw SAS 1 FAIL light on at turn on or input cmd.	1	1	1	1	X					1	X						
2	Yaw SAS 1 FAIL light on. AP A locked OFF.	1	1			X	1		1/2	1	1		A					
3	Yaw SAS 1 FAIL light did not automatically reset at eng. No. 2 start. Will reset with switchlight.													2	1A13			
4	Yaw SAS 2 FAIL light on at turn on or input cmd	2	2	2	2	X					2	X						
5	Yaw SAS 2 FAIL light on. AP B locked OFF.	2	2			X	2		1/2	2	2		B					
6	Yaw SAS 2 FAIL light did not automatically reset at eng. No. 1 start. Will reset with switchlight.													1	1A5			
7	Yaw SAS 2 FAIL light on, RUDDER HYDR LMTR light comes on when airspeed below 164 knots. "RUDDER FUSING."							X								X	X	
8	DANA light on, Yaw SAS suspect but no yaw SAS FAIL light on. "HIDDEN Fault Exists."	1/2	1/2/3						1/2	1/2								
9	Both yaw SAS FAIL lights on at turn on. "Two Faults Exist."	1/2	1/2/3	1/2	1/2	X	1/2		1/2	1/2	1/2	X	A/B					
10	Both yaw SAS FAIL lights come on during turn coordination. Flaps up.	1/2	1/2/3															
11	Both yaw SAS FAIL lights come on during turn coordination. Flaps down.	1/2	1/2/3						1/2	1/2								
12	Rudder pedals require too much force to operate rudder. Rudder pedals operate normal when yaw SAS 1 (2) is turned off.																	B/A
13	Full rudder travel not available with YAW SAS 1, 2 or both on. Moves part way at normal rate, then creeps slowly.	1/2											A/B					

HOW TO USE

1 Find flight squawk in FAULTS column

2 Check FIM on LRUs listed in FIM column related to FAULTS. Black FIM - LRU good; White or Yellow FIM = Replace LRU

3 If problem persists: Refer to Fig. 104

M1-0005-22-616

R
R

Yaw SAS System Fault Matrix
Figure 103 (Sheet 1)

EFFECTIVITY: ALL

0018

Abbreviations		Remove and Install Ref.	
		Chapt	Page
AIL POSN XDCR	Left Inboard Aileron Dual Position Transducer	22-13-03	401
AP PRESS SW	Rudder Autopilot Servo Pressure Switch	27-21-24	401
EHV	Rudder Servo Electrical Servo Valve	27-21-09	401
ENG PRESS SW	Engine Hi-Press Filter Module Pressure Switch	29-32-01	401
FCES CP	FCES Control Panel	22-10-07	401
FLAP PDU SB	Flap PDU Switch Box	27-51-07	401
FUSE ΔP CV	Hydraulic Fusing Differential Pressure Sensing Check Valve	29-11-75	401
ILCB CARD	Indicator Lights Control Box Card	33-17-04	401
PC	Pitch Computer	22-11-01	401
RUD SVO	Rudder Servo Module	27-21-07	401
RUD SOV	Rudder Servo Module AP A (B) Hydraulic Sys B (A) Shutoff Valve	27-21-08	401
RUD FUSE	Rudder Fusing - Reset FUSE per Fig. 104 FAULT 7		
RUD FUSE SOV	Motor Operated Rudder Hydraulic Fusing Shutoff Valve	29-11-74	401
RUD POSN XDCR	Rudder Dual Position Transducer	22-15-03	401
SOV	Yaw SAS 1 (2) Hydraulic System B (A) Shutoff Valve	27-21-08	401
YC	Yaw Computer	22-15-01	401
YRG	Yaw Rate Gyro	22-15-02	401
X	One LRU common to both sys		
1 OR A	No. 1 LRU associated with Sys 1 problem		
2 OR B	No. 2 LRU associated with Sys 2 problem		
3	No. 3 LRU common to both sys		

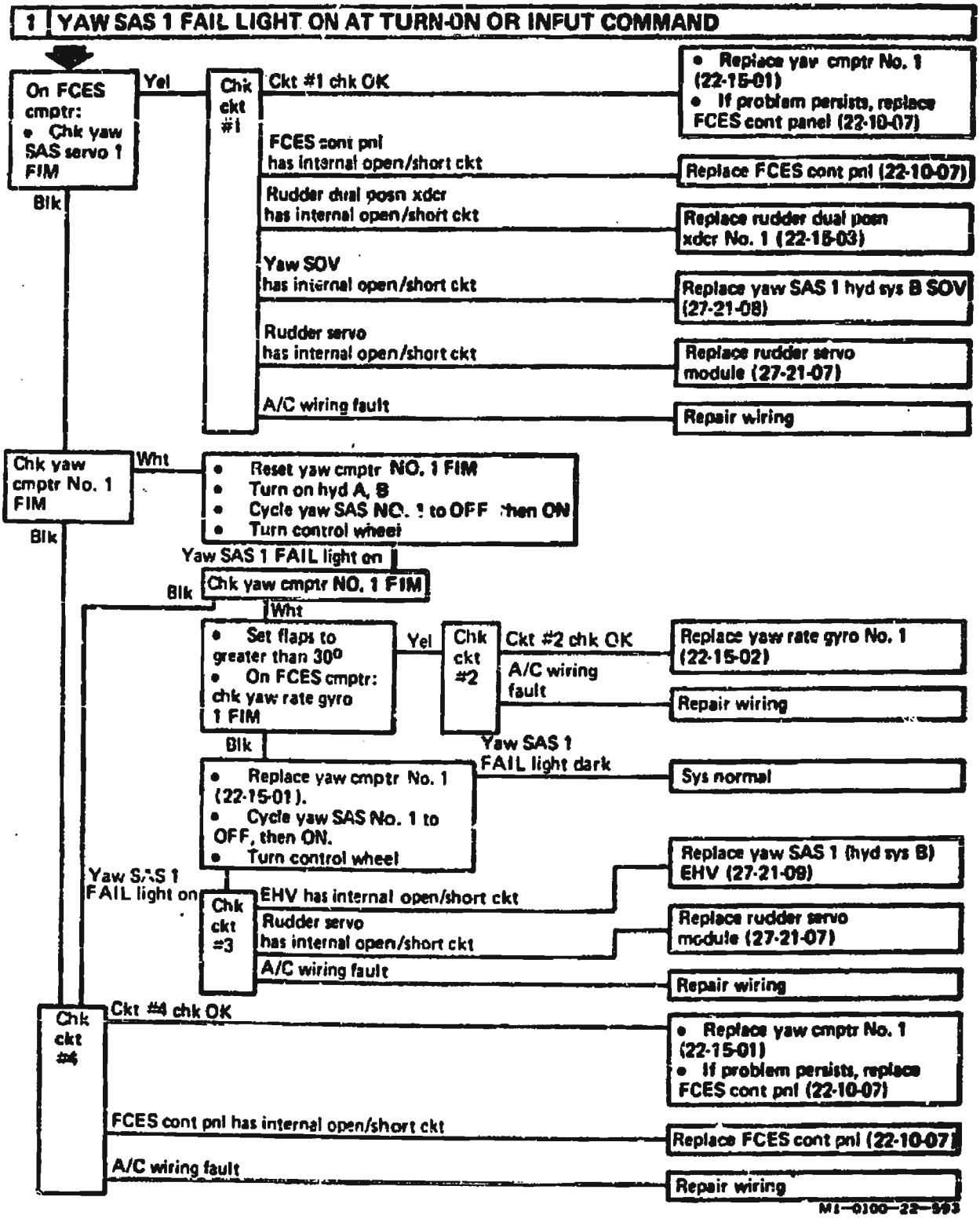
M1-0003-22-622

R
R

Yaw SAS System Fault Matrix
Figure 103 (Sheet 2)

EFFECTIVITY: ALL

001B


1 YAW SAS 1 FAIL LIGHT ON AT TURN-ON OR INPUT COMMAND
On FCES cmptr:
• Chk yaw SAS servo 1 FIM
Yel
Blk
Chk ckt #1
Ckt #1 chk OK
• Replace yaw cmptr No. 1 (22-15-01)
• If problem persists, replace FCES cont panel (22-10-07)
FCES cont pnl has internal open/short ckt
Replace FCES cont pnl (22-10-07)
Rudder dual posn xdcr has internal open/short ckt
Replace rudder dual posn xdcr No. 1 (22-15-03)
Yaw SOV has internal open/short ckt
Replace yaw SAS 1 hyd sys B SOV (27-21-08)
Rudder servo has internal open/short ckt
Replace rudder servo module (27-21-07)
A/C wiring fault
Repair wiring
Chk yaw cmptr No. 1 FIM
Wht
Blk
• Reset yaw cmptr NO. 1 FIM
• Turn on hyd A, B
• Cycle yaw SAS NO. 1 to OFF then ON
• Turn control wheel
Yaw SAS 1 FAIL light on
Chk yaw cmptr NO. 1 FIM
Blk
Wht
• Set flaps to greater than 30°
• On FCES cmptr: chk yaw rate gyro 1 FIM
Yel
Chk ckt #2
Ckt #2 chk OK
A/C wiring fault
Replace yaw rate gyro No. 1 (22-15-02)
Repair wiring
Blk
Yaw SAS 1 FAIL light dark
Sys normal
• Replace yaw cmptr No. 1 (22-15-01).
• Cycle yaw SAS No. 1 to OFF, then ON.
• Turn control wheel
Yaw SAS 1 FAIL light on
Chk ckt #3
EHV has internal open/short ckt
Replace yaw SAS 1 (hyd sys B) EHV (27-21-09)
Rudder servo has internal open/short ckt
Replace rudder servo module (27-21-07)
A/C wiring fault
Repair wiring
Chk ckt #4
Ckt #4 chk OK
• Replace yaw cmptr No. 1 (22-15-01)
• If problem persists, replace FCES cont pnl (22-10-07)
FCES cont pnl has internal open/short ckt
Replace FCES cont pnl (22-10-07)
A/C wiring fault
Repair wiring
MI-0100-22-593

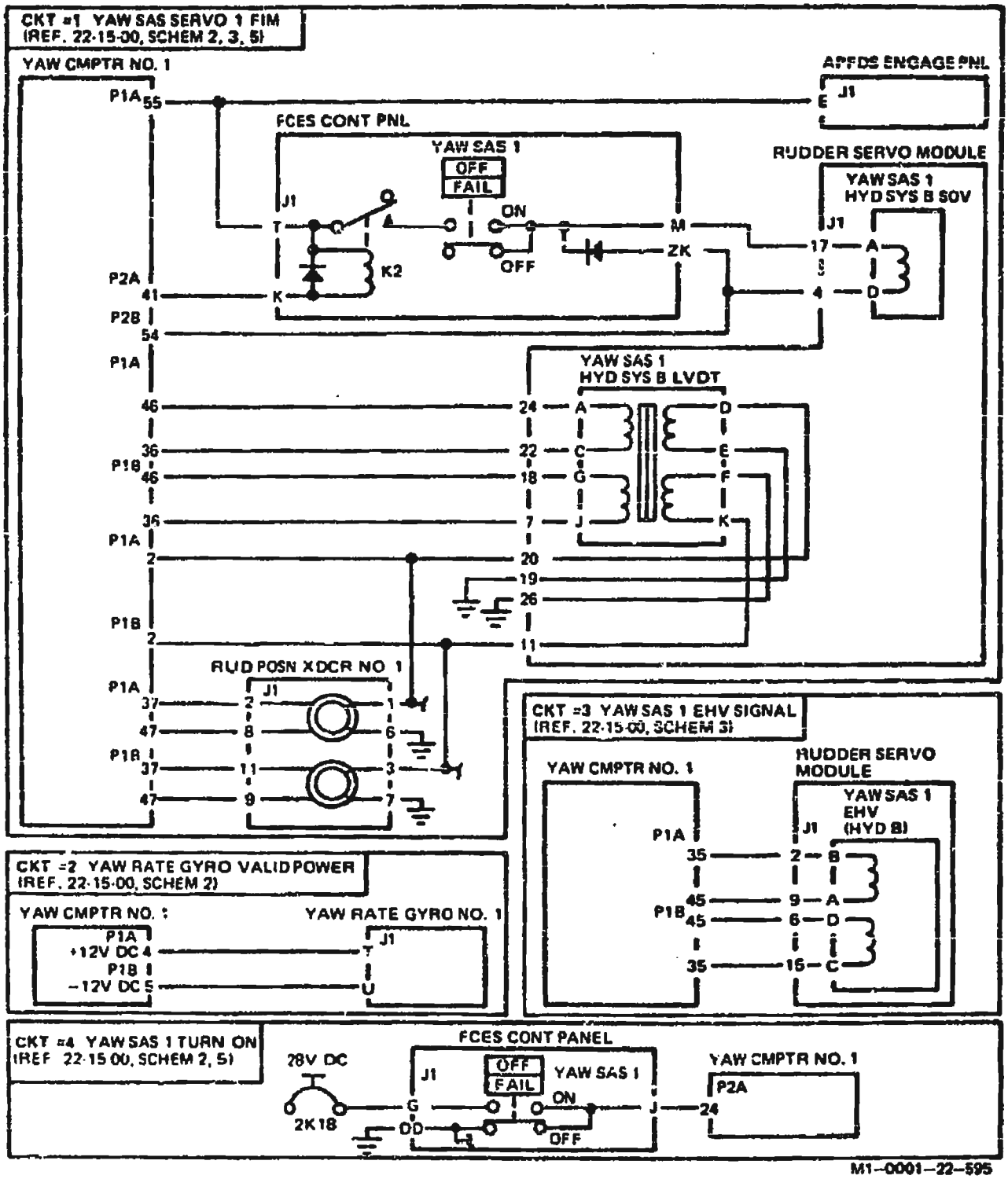
R
R

Yaw SAS System Faults
Figure 104 (Sheet 1)

EFFECTIVITY: ALL

0018

1 CONTINUED



Yaw SAS System Faults
Figure 104 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

2 YAW SAS 1 FAIL LIGHT ON. AP A LOCKED-OFF

Yaw cmptr No. 1 FIM wht (Faulty YC-1 power supply ckt).
- Chk ckt =1

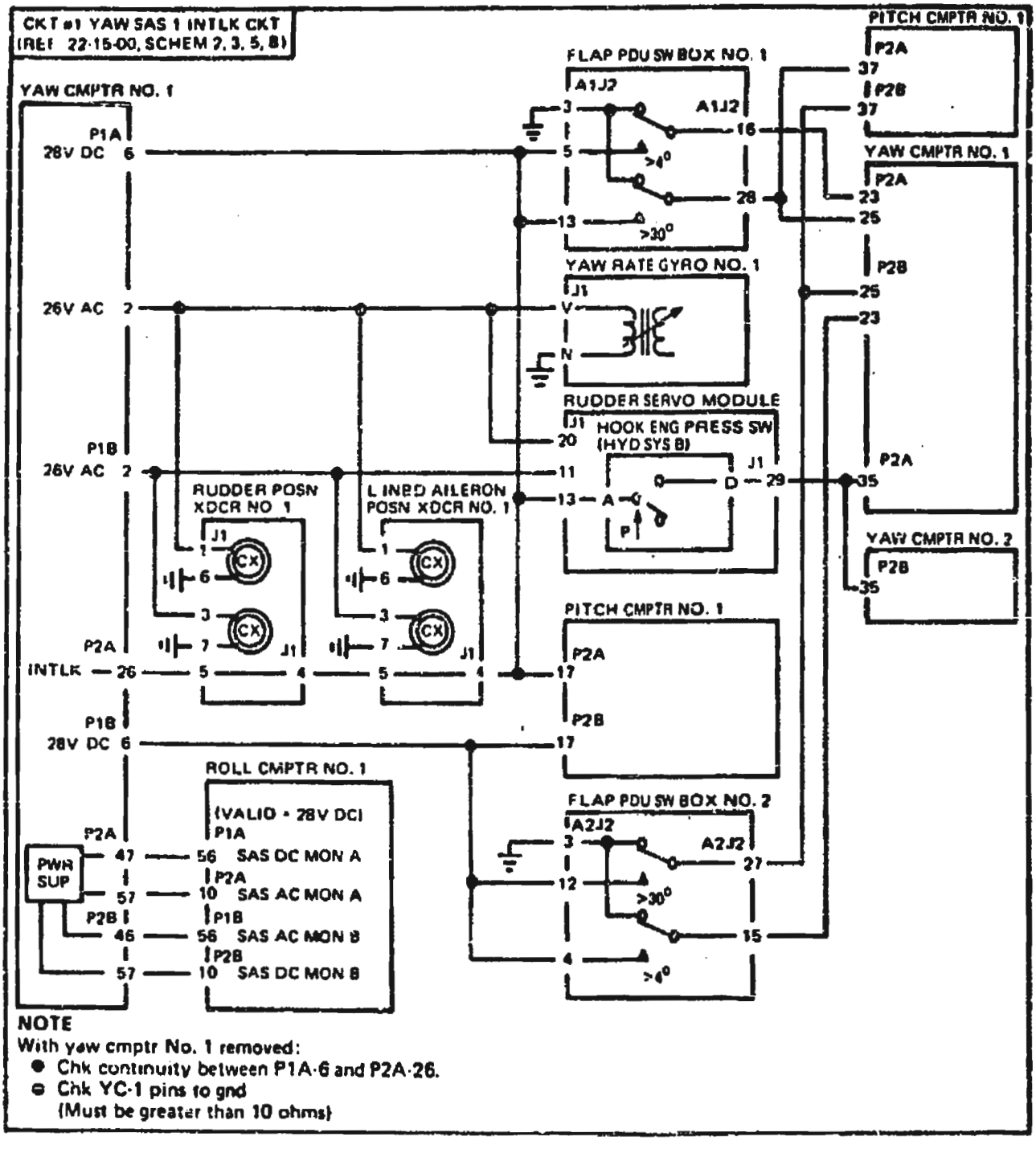
Ckt =1 chk OK	Replace yaw cmptr No. 1 (22-15-01)
Open ckt between P1A-6 and P2A-26	Replace open LRU: • Rudder dual posn XDCR No. 1 (22-15-03). • L inbd aileron posn XDCR No. 1 (22-13-03)
P1A-6 short to gnd (less than 10 ohms)	Replace shorted LRU/1\: • Flap PDU sw box No. 1 (27-51-12). • Pitch cmptr No. 1 (22-11-01). • AP A hyd sys B press sw (27-21-24). • Rudder servo module (27-21-07)
P1B-6 short to gnd (less than 10 ohms)	Replace shorted LRU/1\: • Flap PDU sw box No. 2 (27-51-12). • Pitch cmptr No. 1 (22-11-01)
P1A-2 or P1B-2 short to gnd (less than 10 ohms)	Replace shorted LRU/1\: • Yaw rate gyro No. 1 (22-15-02). • L inbd aileron posn XDCR No. 1 (22-13-03). • Rudder dual posn XDCR No. 1 (22-15-03). • Rudder servo module (27-21-07)

/1\ **NOTE**
Replace yaw cmptr No. 1 (22-15-01) after faulted (shorted) LRU is replaced

M1-0002-22-596

Yaw SAS System Faults
Figure 104 (Sheet 3)

2 CONTINUED



NOTE

With yaw cmptr No. 1 removed:

- Chk continuity between P1A-6 and P2A-26.
- Chk YC-1 pins to gnd
  (Must be greater than 10 ohms)

M1-G002-22-597

Yaw SAS System Faults
Figure 104 (Sheet 4)

3 YAW SAS 1 FAIL LIGHT DID NOT AUTOMATICALLY RESET AT ENGINE NO. 2 START. WILL RESET WITH SWITCH LIGHT

Is hyd sys B OUTLET PUMP LO PR legend on?

NO → On flt eng LIGHTS panel, depress TEST sw to ON.
- Does hyd sys B LO PR legend come on?

NO → Replace hyd sys B OUTLET LO PR lamp (20-33-03) or 1A13 card (33-17-04)

YES → Chk ckt #1 (P10-39 to gnd)

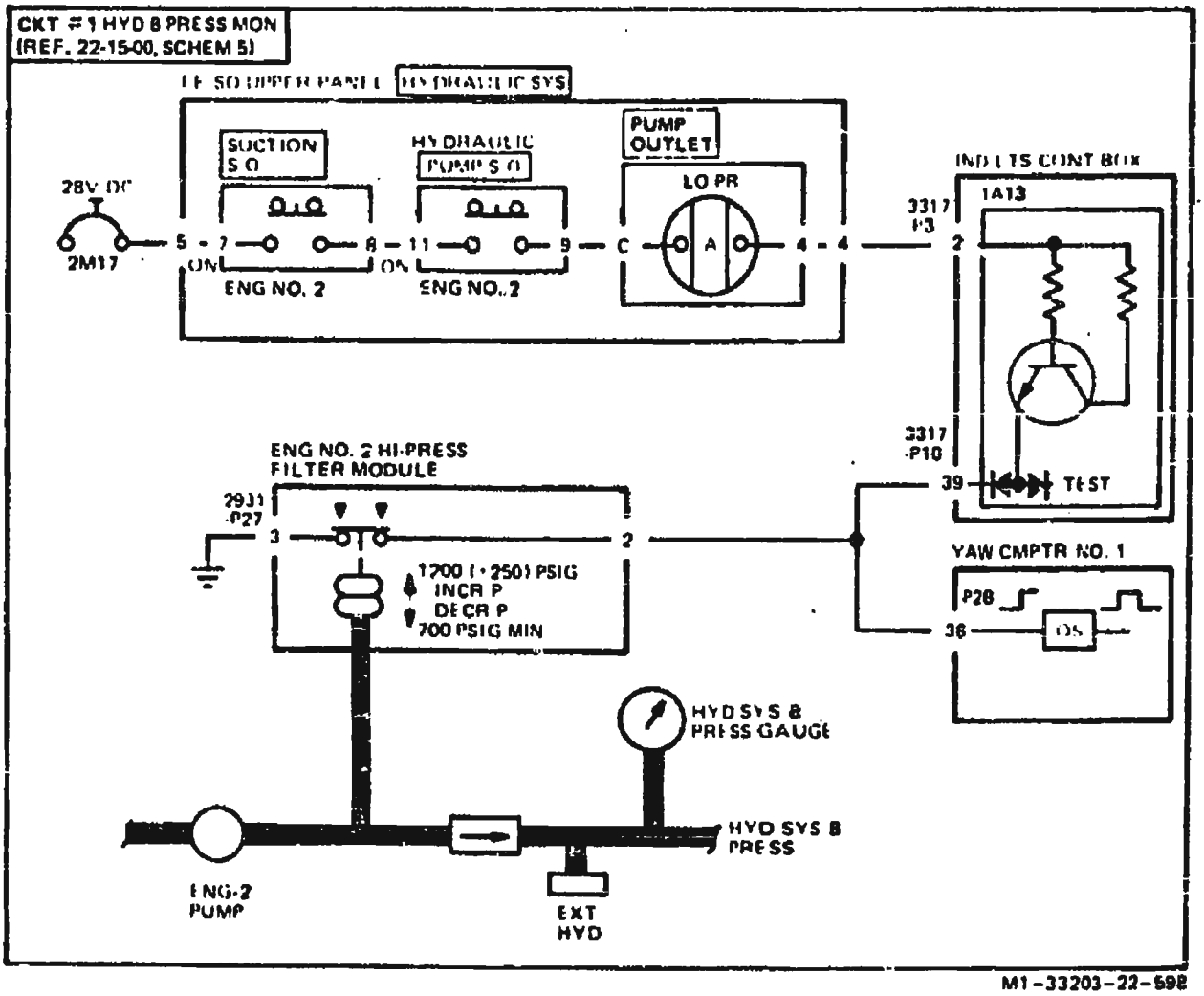
Ckt OK → Replace card 1A13 (33-17-04)

Ckt open → Replace hyd sys B low press. sw 2932-S23 (29-32-01) or repair wiring

YES

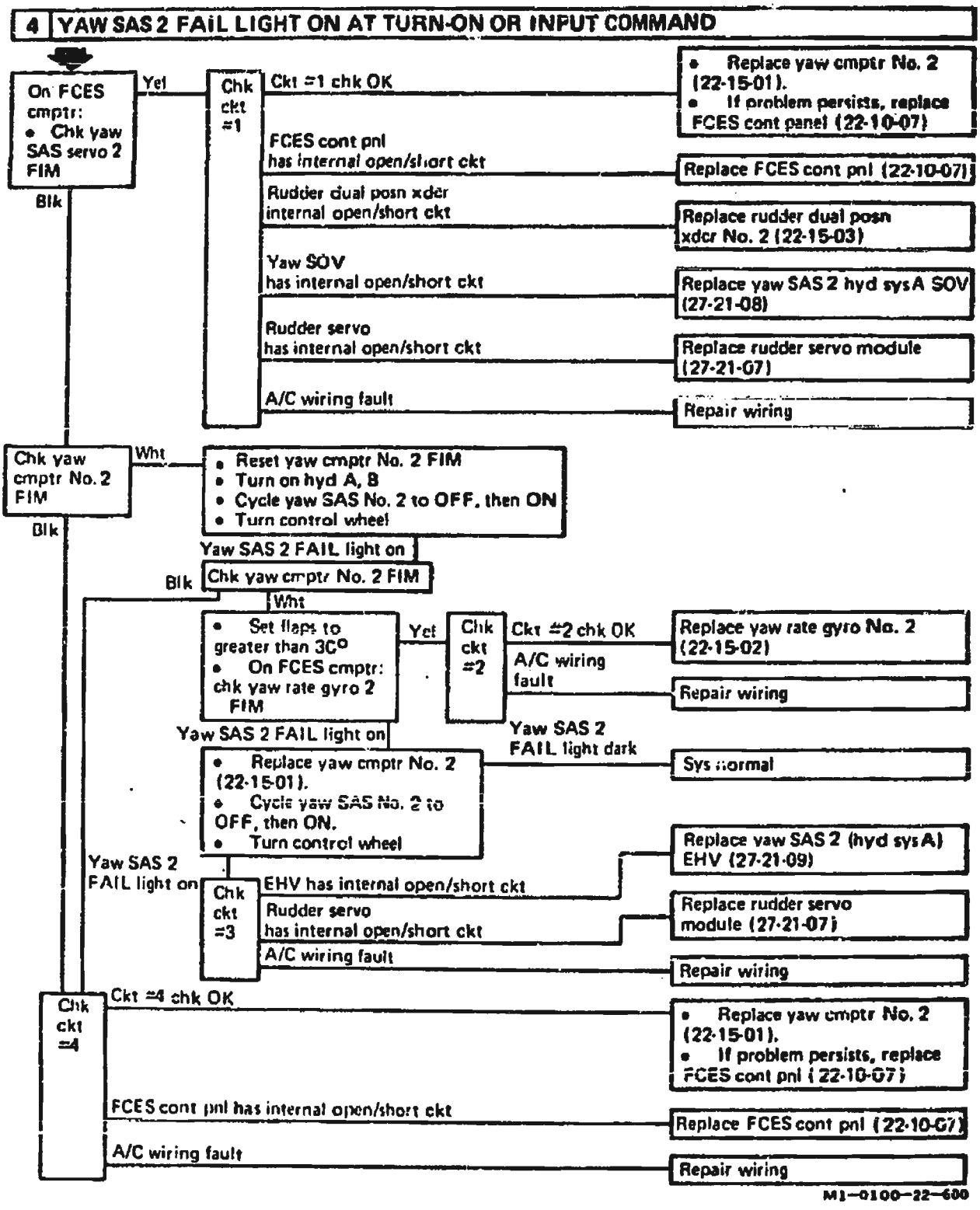
See ckt #1

If LO PR legend did not go out after engine start, trouble shoot HYD SYS B (Ref. 29-11-00)



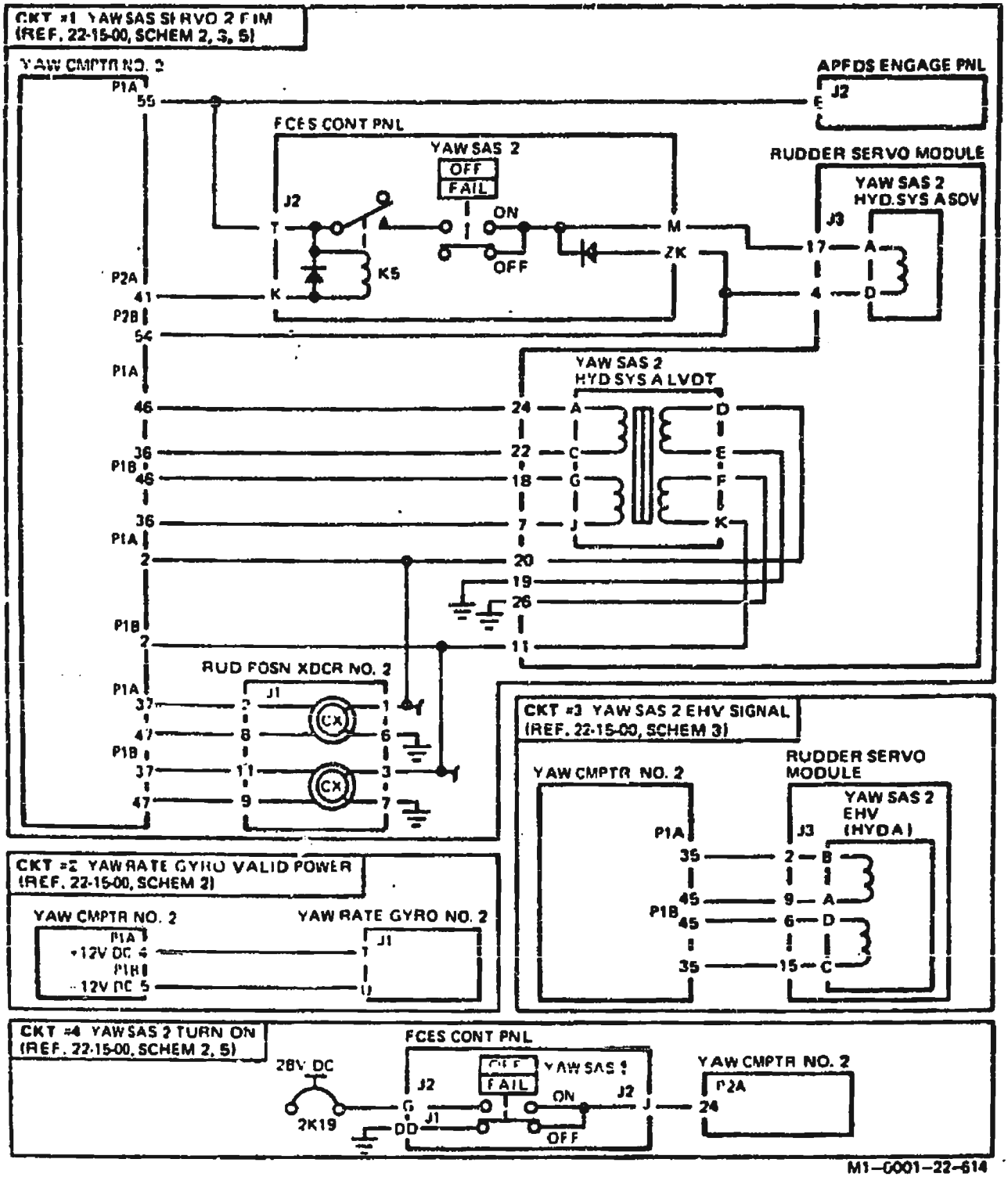
M1-33203-22-598

Yaw SAS System Faults
Figure 104 (Sheet 5)

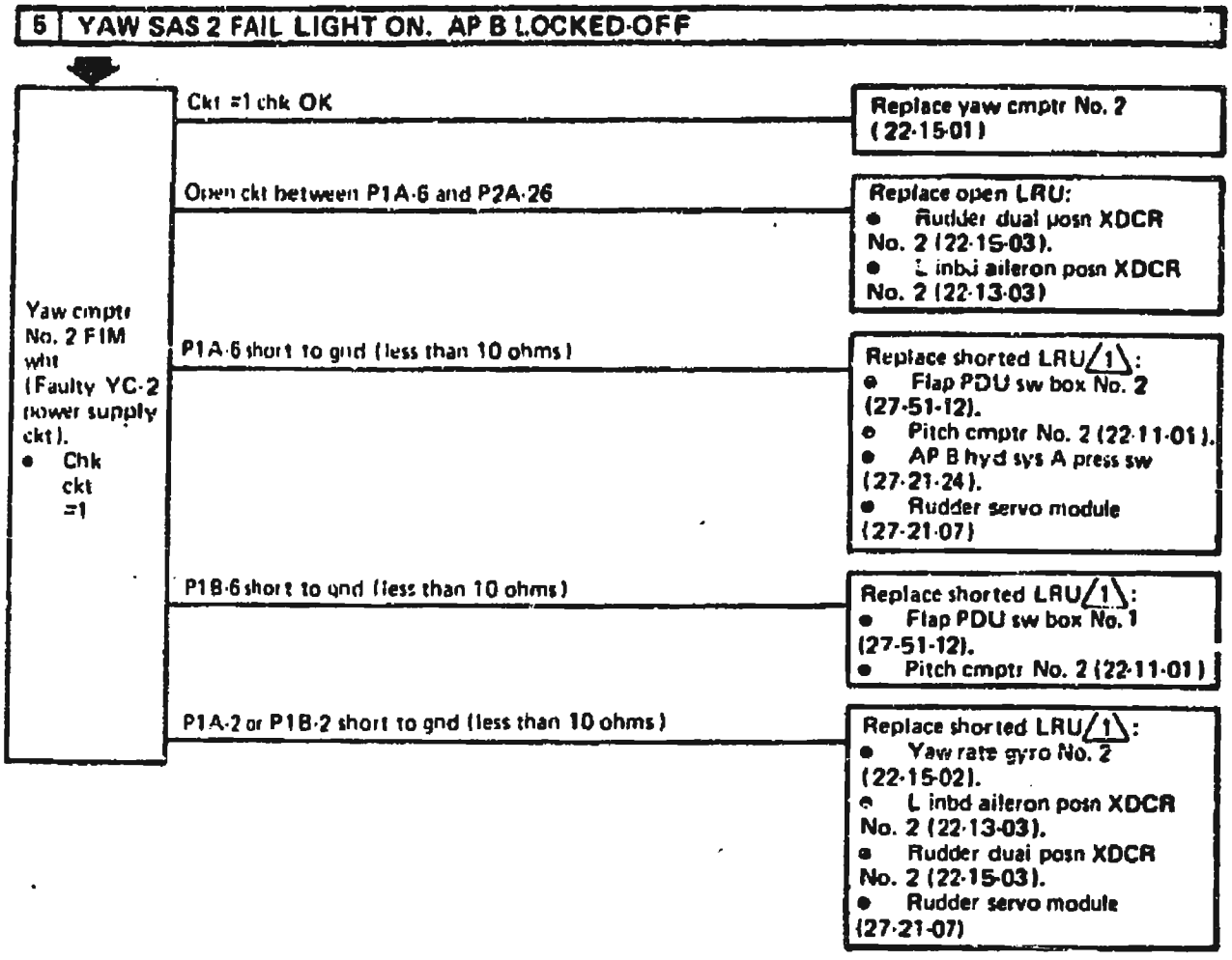

4 YAW SAS 2 FAIL LIGHT ON AT TURN-ON OR INPUT COMMAND
On FCES cmptr:
• Chk yaw SAS servo 2 FIM
Yel
Blk
Chk ckt =1
Ckt =1 chk OK
• Replace yaw cmptr No. 2 (22-15-01).
• If problem persists, replace FCES cont panel (22-10-07)
FCES cont pnl has internal open/short ckt
Replace FCES cont pnl (22-10-07)
Rudder dual posn xdcr internal open/short ckt
Replace rudder dual posn xdcr No. 2 (22-15-03)
Yaw SOV has internal open/short ckt
Replace yaw SAS 2 hyd sysA SOV (27-21-08)
Rudder servo has internal open/short ckt
Replace rudder servo module (27-21-07)
A/C wiring fault
Repair wiring
Chk yaw cmptr No. 2 FIM
Wht
Blk
• Reset yaw cmptr No. 2 FIM
• Turn on hyd A, B
• Cycle yaw SAS No. 2 to OFF, then ON
• Turn control wheel
Yaw SAS 2 FAIL light on
Chk yaw cmptr No. 2 FIM
Blk
Wht
• Set flaps to greater than 3C°
• On FCES cmptr: chk yaw rate gyro 2 FIM
Yel
Chk ckt =2
Ckt =2 chk OK
Replace yaw rate gyro No. 2 (22-15-02)
A/C wiring fault
Repair wiring
Yaw SAS 2 FAIL light on
Yaw SAS 2 FAIL light dark
Sys normal
• Replace yaw cmptr No. 2 (22-15-01).
• Cycle yaw SAS No. 2 to OFF, then ON.
• Turn control wheel
Yaw SAS 2 FAIL light on
Chk ckt =3
EHV has internal open/short ckt
Replace yaw SAS 2 (hyd sysA) EHV (27-21-09)
Rudder servo has internal open/short ckt
Replace rudder servo module (27-21-07)
A/C wiring fault
Repair wiring
Chk ckt =4
Ckt =4 chk OK
• Replace yaw cmptr No. 2 (22-15-01).
• If problem persists, replace FCES cont pnl (22-10-07)
FCES cont pnl has internal open/short ckt
Replace FCES cont pnl (22-10-07)
A/C wiring fault
Repair wiring
M1-0100-22-600

Yaw SAS System Faults
Figure 104 (Sheet 6)

4 CONTINUED


CKT #1 YAW SAS SERVO 2 FIM (REF. 22-15-00, SCHEM 2, 3, 5)
YAW CMPTR NO. 2
APFDS ENGAGE PNL
FCES CONT PNL
YAW SAS 2
OFF
FAIL
ON
OFF
RUDDER SERVO MODULE
YAW SAS 2 HYD.SYS A SOV
K5
YAW SAS 2 HYD SYS A LVDT
RUD POSN XDCR NO. 2
CKT #3 YAW SAS 2 EHV SIGNAL (REF. 22-15-00, SCHEM 3)
RUDDER SERVO MODULE
YAW SAS 2 EHV (HYD A)
CKT #2 YAW RATE GYRO VALID POWER (REF. 22-15-00, SCHEM 2)
YAW RATE GYRO NO. 2
+12V DC
-12V DC
CKT #4 YAW SAS 2 TURN ON (REF. 22-15-00, SCHEM 2, 5)
28V DC
2K19
M1-G001-22-614

Yaw SAS System Faults
Figure 104 (Sheet 7)

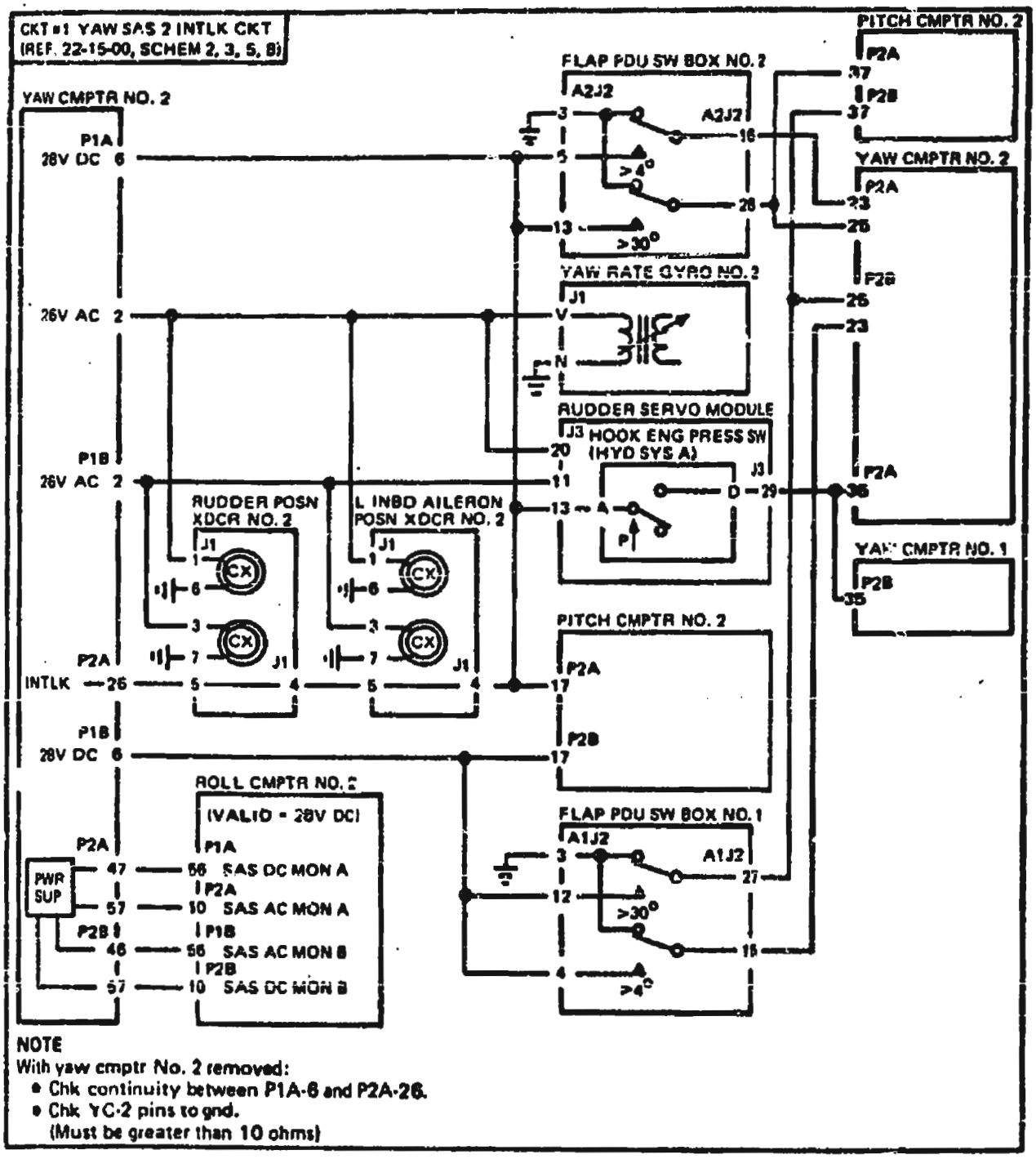

5 YAW SAS 2 FAIL LIGHT ON. AP B LOCKED-OFF
Yaw cmptr No. 2 FIM whr (Faulty YC-2 power supply ckt).
• Chk ckt =1
Ckt =1 chk OK
Replace yaw cmptr No. 2 (22-15-01)
Open ckt between P1A-6 and P2A-26
Replace open LRU:
• Rudder dual posn XDCR No. 2 (22-15-03).
• L inbd aileron posn XDCR No. 2 (22-13-03)
P1A-6 short to gnd (less than 10 ohms)
Replace shorted LRU/1\:
• Flap PDU sw box No. 2 (27-51-12).
• Pitch cmptr No. 2 (22-11-01).
• AP B hyd sys A press sw (27-21-24).
• Rudder servo module (27-21-07)
P1B-6 short to gnd (less than 10 ohms)
Replace shorted LRU/1\:
• Flap PDU sw box No. 1 (27-51-12).
• Pitch cmptr No. 2 (22-11-01)
P1A-2 or P1B-2 short to gnd (less than 10 ohms)
Replace shorted LRU/1\:
• Yaw rate gyro No. 2 (22-15-02).
• L inbd aileron posn XDCR No. 2 (22-13-03).
• Rudder dual posn XDCR No. 2 (22-15-03).
• Rudder servo module (27-21-07)

/1\ **NOTE**
Replace yaw cmptr No. 2 (22-15-01) after faulted (shorted) LRU is replaced

M1-0002-22-602

Yaw SAS System Faults
Figure 104 (Sheet 8)

5 CONTINUED



NOTE
With yaw cmptr No. 2 removed:
- Chk continuity between P1A-6 and P2A-26.
- Chk YC-2 pins to gnd.
  (Must be greater than 10 ohms)

M1-0002-22-615

Yaw SAS System Faults
Figure 104 (Sheet 9)

6 YAW SAS 2 FAIL LIGHT DID NOT AUTOMATICALLY RESET AT ENGINE NO. 1 START. WILL RESET WITH SWITCH LIGHT

Is hyd sys A OUTLET PUMP LO PR legend on?

NO → On flt eng LIGHTS panel, depress TEST sw to ON,
- Does hyd sys A LO PR legend come on?

NO → Replace hyd sys A OUTLET LO PR lamp (20-33-03 or 1A5 card (33-17-00)

YES → Chk ckt #1 (P22-12 to gnd)

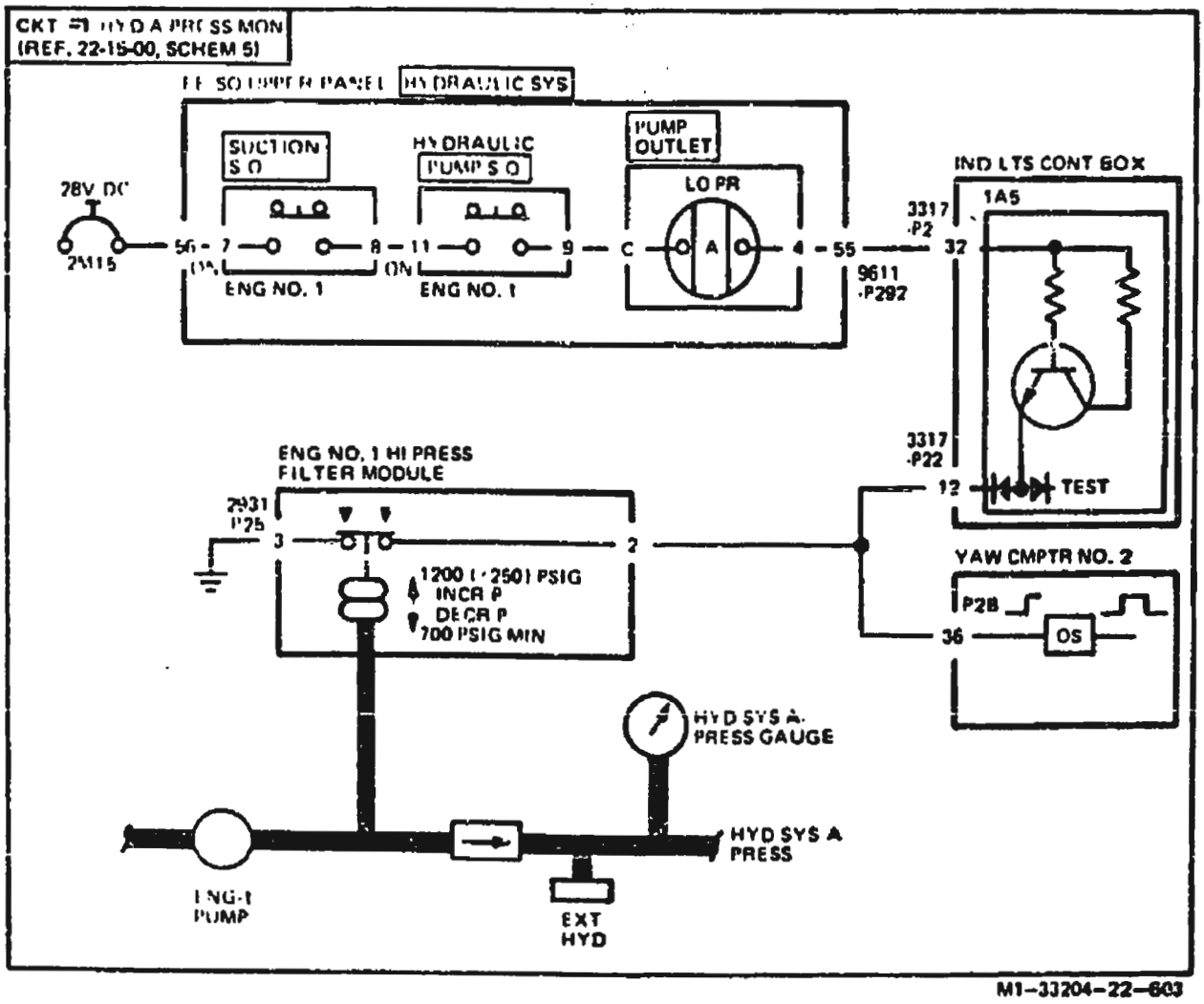
Ckt OK → Replace 1A5 card (33-17-04)

Ckt open → Replace hyd sys A low press sw 2932-S21 (29-32-01) or repair wiring

YES

See ckt #1

If LO PR legend did not go out after engine start, trouble shoot HYD SYS A (Ref. 29-11-00)



M1-33204-22-603

Yaw SAS System Faults
Figure 104 (Sheet 10)

7 YAW SAS 2 FAIL LIGHT ON. RUDDER HYDR LMTR LIGHT CAME ON WHEN AIRSPEED DROPPED BELOW 164 KNOTS, "RUDDER FUSING."

Chk quantity gauge on SO/FE panel for loss of hyd sys A fluid

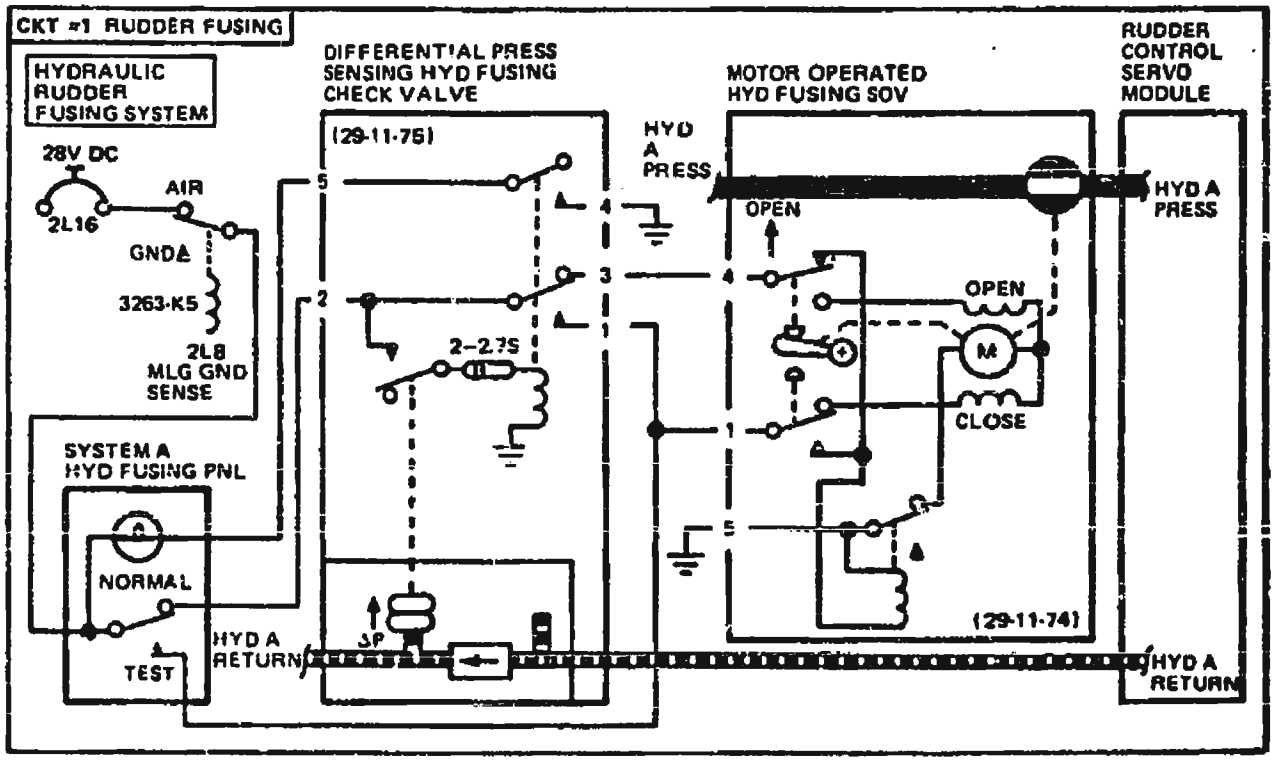
Loss of FLUID in hyd sys A → Perform necessary maintenance (29-11-00, 601)

Fluid level OK

Reset the FUSE as follows:
- Press hyd sys A
- Open 2L8 CB
- Open, then close 2L16 several times. It may be necessary to cycle this CB several times. If so, allow 4-sec interval between cycles to permit a time delay in the fuse to operate
- Close 2L8 CB

Yaw SAS 2 FAIL light out → Sys normal

Yaw SAS 2 FAIL light on → Chk ckt #1 and troubleshoot per 29-11-00



MI-0100-22-605

Yaw SAS System Faults
Figure 104 (Sheet 11)

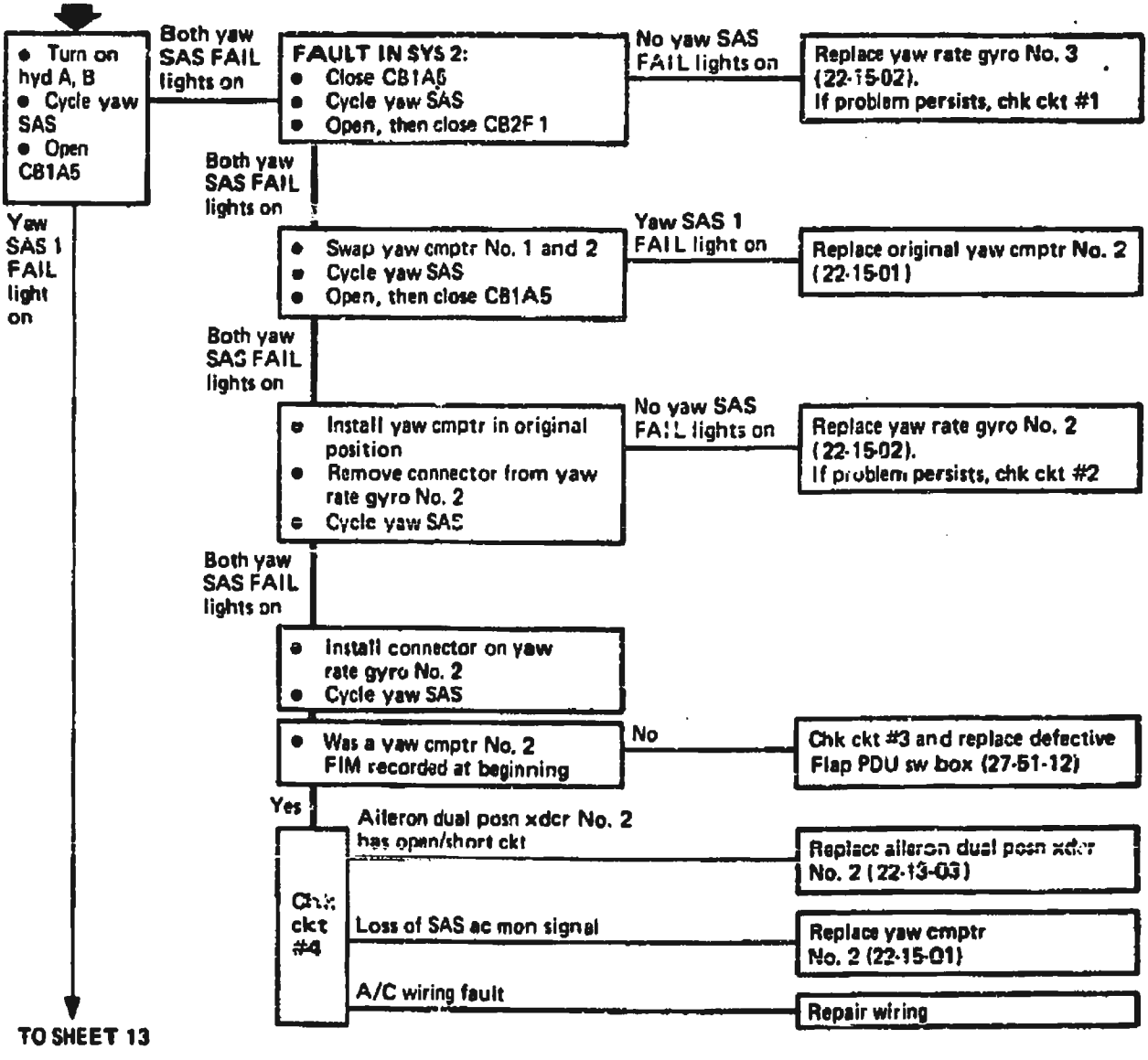
R EFFECTIVITY: ALL
R
0018

9 DANA LIGHT ON. POSSIBLE YAW SAS PROBLEM BUT NO YAW SAS FAIL LIGHT

HIDDEN FAULT EXISTS

- Chk FIM on yaw cmptr No. 1 and No. 2. Record if wht
- Chk yaw rate gyros 1, 2 and 3 FIM. Record if yel
- Flaps must be greater than 30° to set yaw rate gyro FIM
- Cycle yaw SAS means – set yaw SAS 1 and 2 to OFF, allow 1 minute for yaw rate gyros to reach operating speed, and set yaw SAS 1 and 2 to on (dark)
- Open applicable CB when swapping LRU and disconnecting connectors

DETERMINE WHICH YAW SAS HAS HIDDEN FAULT

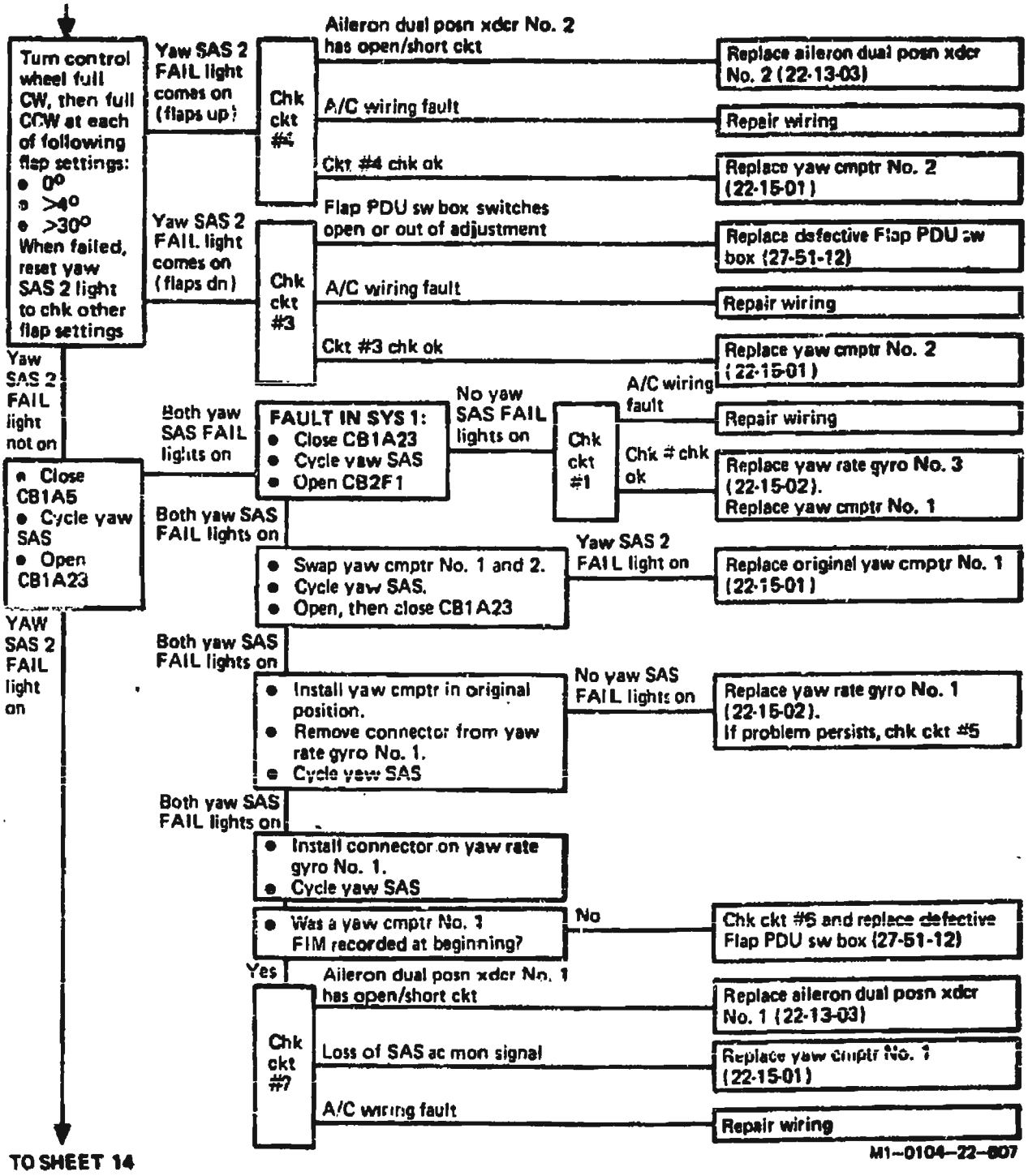

• Turn on hyd A, B
• Cycle yaw SAS
• Open CB1A5
Both yaw SAS FAIL lights on
FAULT IN SYS 2:
• Close CB1A5
• Cycle yaw SAS
• Open, then close CB2F1
No yaw SAS FAIL lights on
Replace yaw rate gyro No. 3 (22-15-02). If problem persists, chk ckt #1
Both yaw SAS FAIL lights on
Yaw SAS 1 FAIL light on
• Swap yaw cmptr No. 1 and 2
• Cycle yaw SAS
• Open, then close CB1A5
Replace original yaw cmptr No. 2 (22-15-01)
Yaw SAS 1 FAIL light on
Both yaw SAS FAIL lights on
• Install yaw cmptr in original position
• Remove connector from yaw rate gyro No. 2
• Cycle yaw SAS
No yaw SAS FAIL lights on
Replace yaw rate gyro No. 2 (22-15-02). If problem persists, chk ckt #2
Both yaw SAS FAIL lights on
• Install connector on yaw rate gyro No. 2
• Cycle yaw SAS
• Was a yaw cmptr No. 2 FIM recorded at beginning
No
Chk ckt #3 and replace defective Flap PDU sw box (27-51-12)
Yes
Chk ckt #4
Aileron dual posn xdcr No. 2 has open/short ckt
Replace aileron dual posn xdcr No. 2 (22-13-03)
Loss of SAS ac mon signal
Replace yaw cmptr No. 2 (22-15-01)
A/C wiring fault
Repair wiring
TO SHEET 13

M1-0003-22-808

Yaw SAS System Faults
Figure 104 (Sheet 12)

8 | CONTINUED

FROM SHEET 12


Turn control wheel full CW, then full CCW at each of following flap settings:
• 0°
• >4°
• >30°
When failed, reset yaw SAS 2 light to chk other flap settings
Yaw SAS 2 FAIL light comes on (flaps up)
Yaw SAS 2 FAIL light comes on (flaps dn)
Chk ckt #4
Chk ckt #3
Aileron dual posn xdcr No. 2 has open/short ckt
A/C wiring fault
Ckt #4 chk ok
Flap PDU sw box switches open or out of adjustment
A/C wiring fault
Ckt #3 chk ok
Replace aileron dual posn xdcr No. 2 (22-13-03)
Repair wiring
Replace yaw cmptr No. 2 (22-15-01)
Replace defective Flap PDU sw box (27-51-12)
Repair wiring
Replace yaw cmptr No. 2 (22-15-01)
Yaw SAS 2 FAIL light not on
• Close CB1A5
• Cycle yaw SAS
• Open CB1A23
Both yaw SAS FAIL lights on
FAULT IN SYS 1:
• Close CB1A23
• Cycle yaw SAS
• Open CB2F1
No yaw SAS FAIL lights on
Chk ckt #1
A/C wiring fault
Chk # chk ok
Repair wiring
Replace yaw rate gyro No. 3 (22-15-02).
Replace yaw cmptr No. 1
Both yaw SAS FAIL lights on
• Swap yaw cmptr No. 1 and 2.
• Cycle yaw SAS.
• Open, then close CB1A23
Yaw SAS 2 FAIL light on
Replace original yaw cmptr No. 1 (22-15-01)
YAW SAS 2 FAIL light on
Both yaw SAS FAIL lights on
• Install yaw cmptr in original position.
• Remove connector from yaw rate gyro No. 1.
• Cycle yaw SAS
No yaw SAS FAIL lights on
Replace yaw rate gyro No. 1 (22-15-02).
If problem persists, chk ckt #5
Both yaw SAS FAIL lights on
• Install connector on yaw rate gyro No. 1.
• Cycle yaw SAS
• Was a yaw cmptr No. 1 FIM recorded at beginning?
No
Chk ckt #5 and replace defective Flap PDU sw box (27-51-12)
Yes
Chk ckt #7
Aileron dual posn xdcr No. 1 has open/short ckt
Loss of SAS ac mon signal
A/C wiring fault
Replace aileron dual posn xdcr No. 1 (22-13-03)
Replace yaw cmptr No. 1 (22-15-01)
Repair wiring
M1-0104-22-807

TO SHEET 14

R Yaw SAS System Faults
R Figure 104 (Sheet 13)

EFFECTIVITY: ALL

001B

8 CONTINUED

From Sheet 13

Turn control wheel full CW, then full CCW at each of following flap settings
- 0°
- -4°
- -30°

When failed, reset yaw SAS 2 light to chk other flap settings

Yaw SAS 1 FAIL light comes on (flaps up)

Chk ckt =7

- Aileron dual posn xdcr No. 1 has open/short ckt → Replace aileron dual posn xdcr (22-13-03)
- A/C wiring fault → Repair wiring
- Ckt =7 chk ok → Replace yaw cmptr No. 1 (22-15-01)

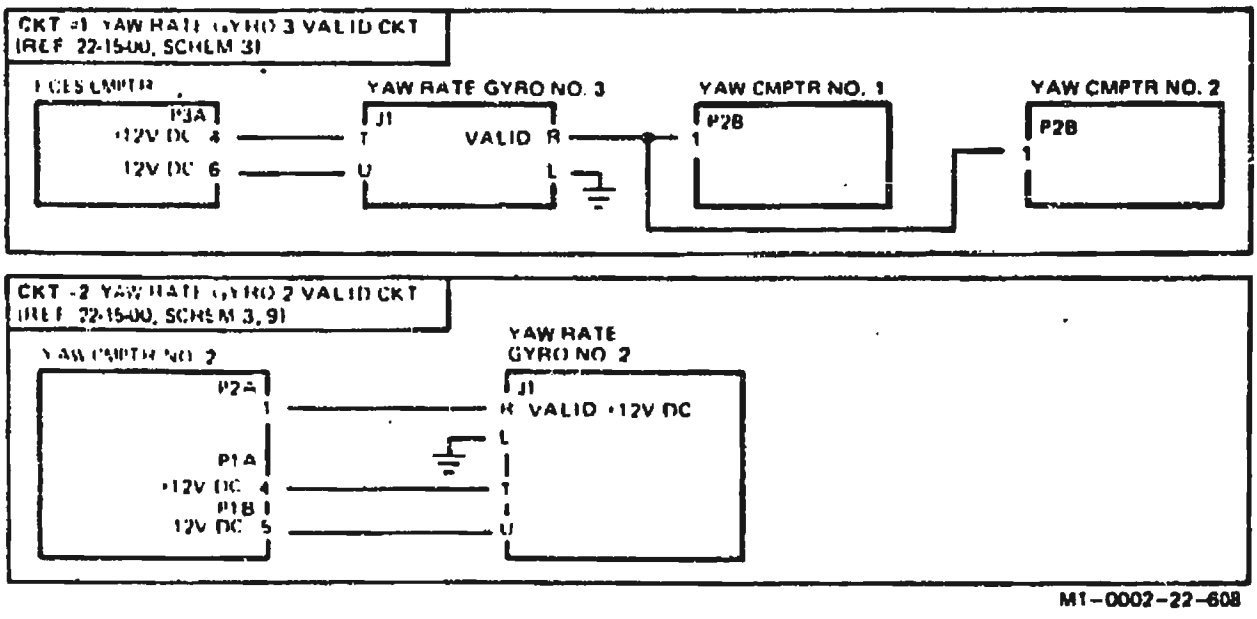
Yaw SAS 1 FAIL light comes on (flaps dn)

Chk ckt =6

- Flap PDU sw box switches open or out of adjustment → Replace defective Flap PDU sw box (27-51-12)
- A/C wiring fault → Repair wiring
- Ckt =6 chk ok → Replace yaw cmptr No. 1 (22-15-01)

Yaw SAS 1 FAIL light not on

Close CB1A23 → HIDDEN DANA FAULT IN SYS OTHER THAN YAW SYS



M1-0002-22-608

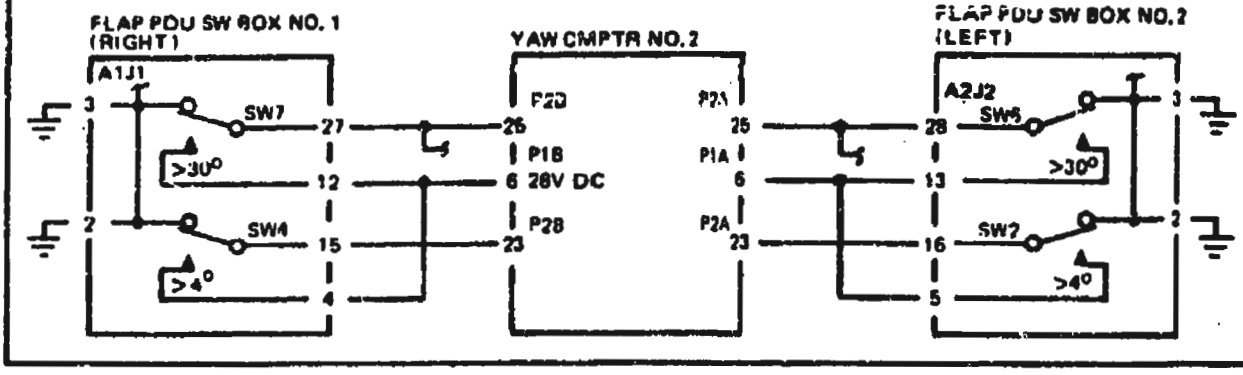
Yaw SAS System Faults
Figure 104 (Sheet 14)

R EFFECTIVITY: ALL

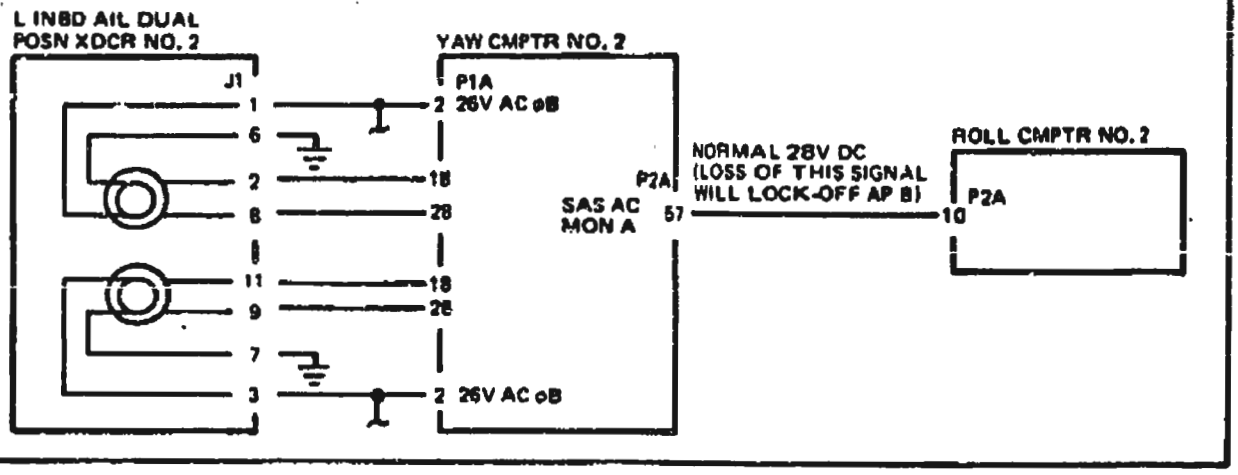
R
0018

8 CONTINUED

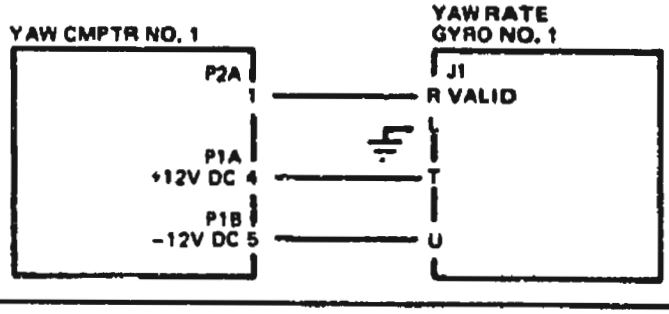
CKT #3 YAW CMPTR NO. 2 FLAP POS INPUT (REF. 22-15-00, SCHEM 8)



CKT #4 YAW CMPTR NO. 2 AIL POS INPUT AND SAS AC VALID SIG (REF. 22-15-00, SCHEM 2, 3)


L INBD AIL DUAL POSN XDCR NO. 2
J1
YAW CMPTR NO. 2
P1A
2 26V AC ø B
SAS AC MON A
NORMAL 28V DC (LOSS OF THIS SIGNAL WILL LOCK-OFF AP B)
ROLL CMPTR NO. 2
P2A
2 26V AC ø B

CKT #5 YAW RATE GYRO 1 VALID CKT (REF. 22-15-00, SCHEM 3, 9)



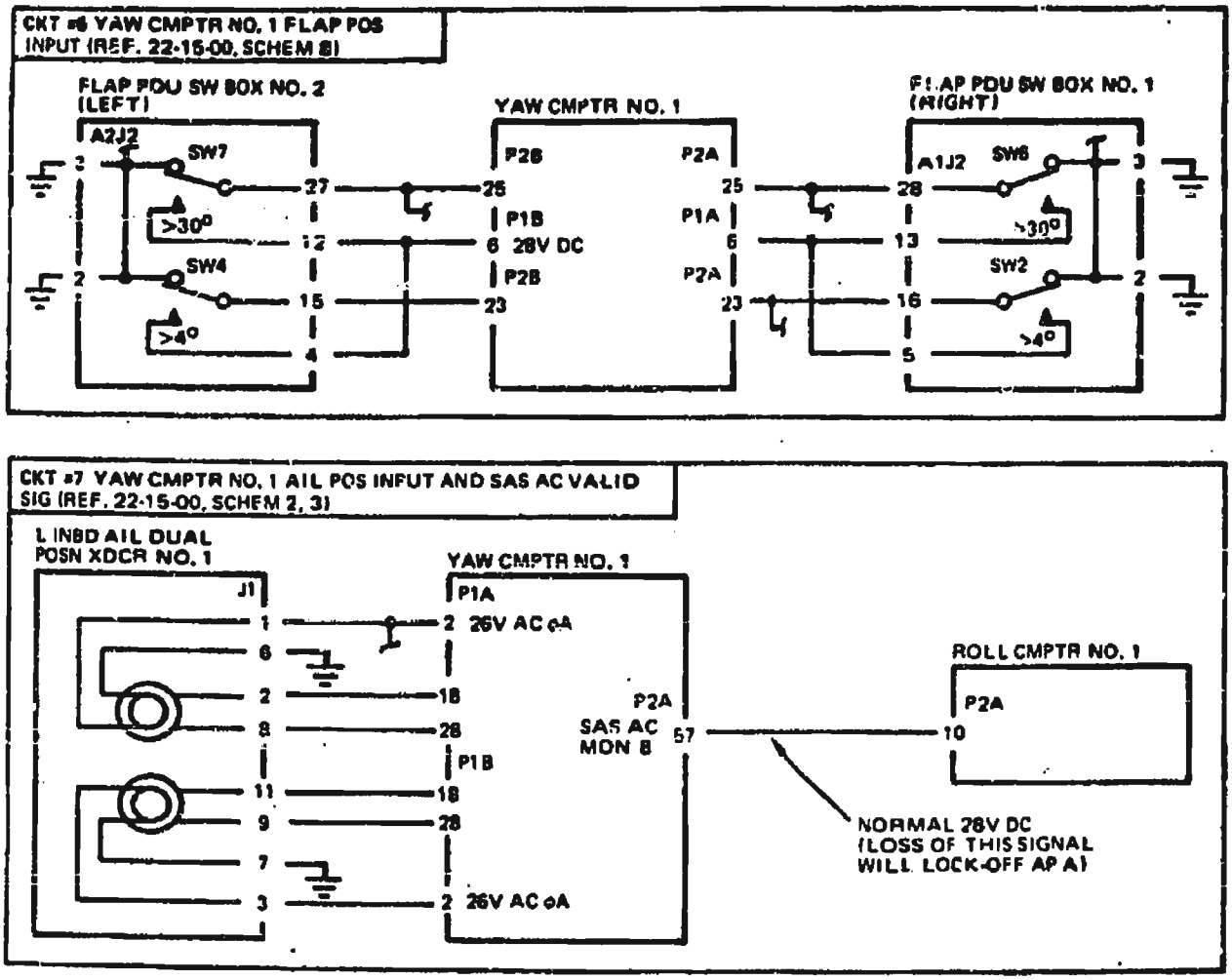
M1-0001-22-609

Yaw SAS System Faults
Figure 104 (Sheet 15)

R EFFECTIVITY: ALL

R 0018

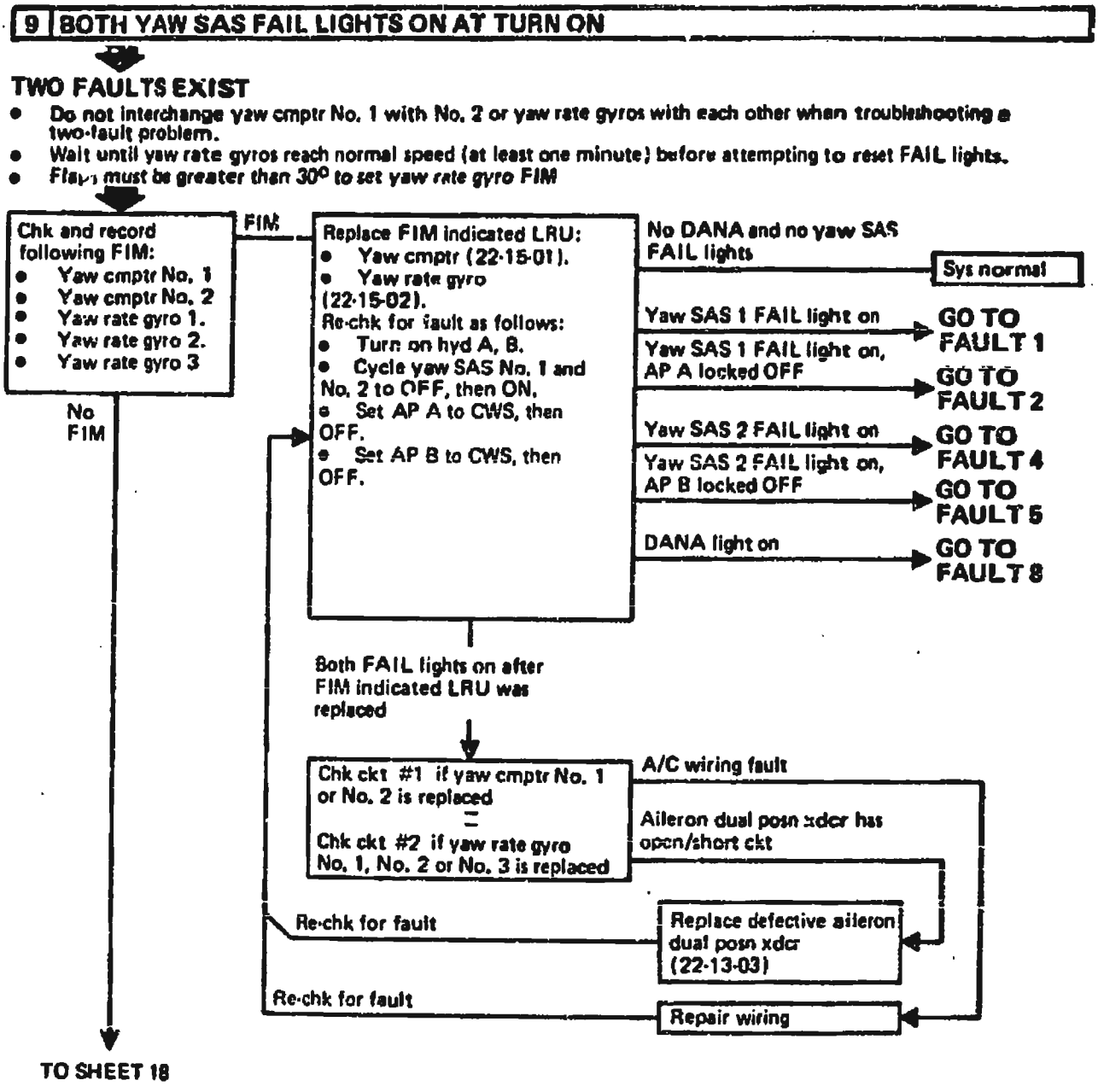
8 CONTINUED



M1-0001-22-620

Yaw SAS System Faults
Figure 104 (Sheet 16)

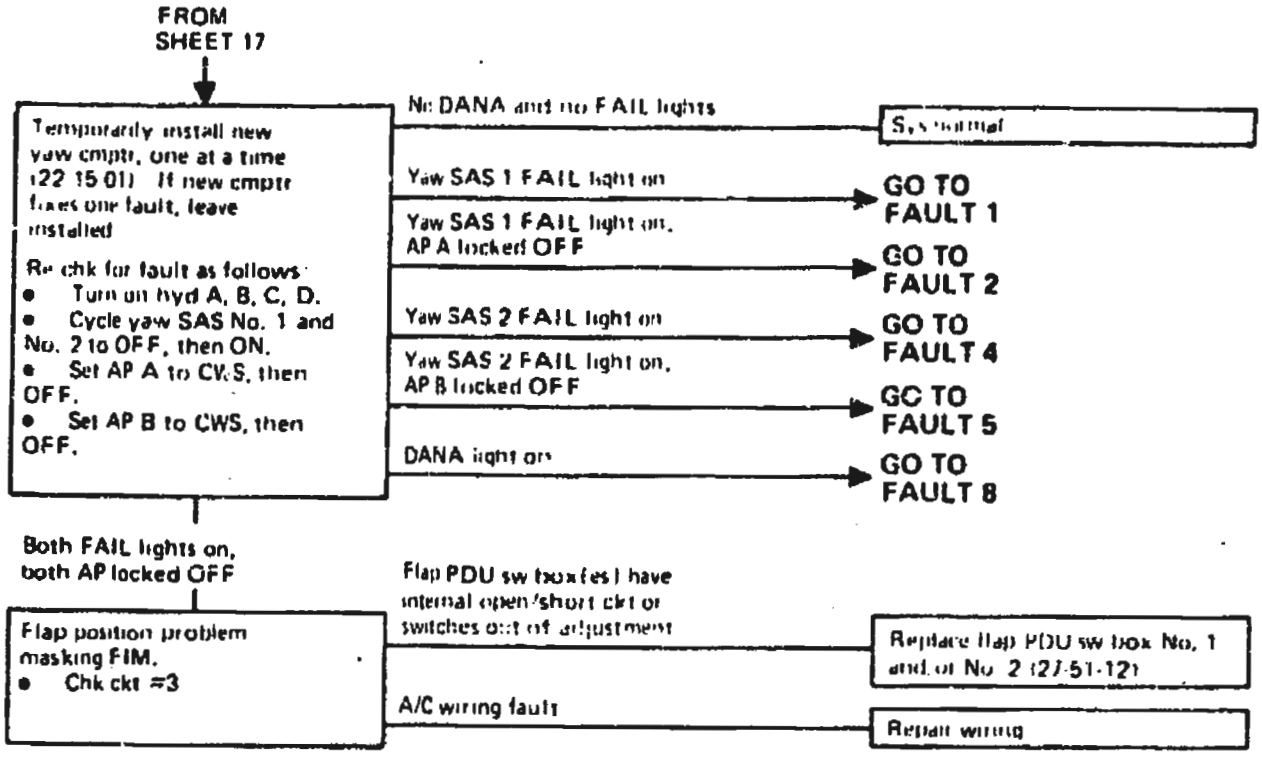
R EFFECTIVITY: ALL
R
001B


9 BOTH YAW SAS FAIL LIGHTS ON AT TURN ON
TWO FAULTS EXIST
• Do not interchange yaw cmptr No. 1 with No. 2 or yaw rate gyros with each other when troubleshooting a two-fault problem.
• Wait until yaw rate gyros reach normal speed (at least one minute) before attempting to reset FAIL lights.
• Flaps must be greater than 30° to set yaw rate gyro FIM
Chk and record following FIM:
• Yaw cmptr No. 1
• Yaw cmptr No. 2
• Yaw rate gyro 1.
• Yaw rate gyro 2.
• Yaw rate gyro 3
FIM
No FIM
Replace FIM indicated LRU:
• Yaw cmptr (22-15-01).
• Yaw rate gyro (22-15-02).
Re-chk for fault as follows:
• Turn on hyd A, B.
• Cycle yaw SAS No. 1 and No. 2 to OFF, then ON.
• Set AP A to CWS, then OFF.
• Set AP B to CWS, then OFF.
No DANA and no yaw SAS FAIL lights
Sys normal
Yaw SAS 1 FAIL light on
GO TO FAULT 1
Yaw SAS 1 FAIL light on, AP A locked OFF
GO TO FAULT 2
Yaw SAS 2 FAIL light on
GO TO FAULT 4
Yaw SAS 2 FAIL light on, AP B locked OFF
GO TO FAULT 5
DANA light on
GO TO FAULT 8
Both FAIL lights on after FIM indicated LRU was replaced
Chk ckt #1 if yaw cmptr No. 1 or No. 2 is replaced
=
Chk ckt #2 if yaw rate gyro No. 1, No. 2 or No. 3 is replaced
A/C wiring fault
Aileron dual posn xdcr has open/short ckt
Re-chk for fault
Replace defective aileron dual posn xdcr (22-13-03)
Re-chk for fault
Repair wiring
TO SHEET 18

M1-0100-22-610

Yaw SAS System Faults
Figure 104 (Sheet 17)

9 CONTINUED


FROM SHEET 17
Temporarily install new yaw cmptr, one at a time (22 15 01). If new cmptr fixes one fault, leave installed
Re-chk for fault as follows:
• Turn on hyd A, B, C, D.
• Cycle yaw SAS No. 1 and No. 2 to OFF, then ON.
• Set AP A to CWS, then OFF.
• Set AP B to CWS, then OFF.
No DANA and no FAIL lights
S, s normal
Yaw SAS 1 FAIL light on
GO TO FAULT 1
Yaw SAS 1 FAIL light on, AP A locked OFF
GO TO FAULT 2
Yaw SAS 2 FAIL light on
GO TO FAULT 4
Yaw SAS 2 FAIL light on, AP B locked OFF
GO TO FAULT 5
DANA light on
GO TO FAULT 8
Both FAIL lights on, both AP locked OFF
Flap position problem masking FIM.
• Chk ckt #3
Flap PDU sw box(es) have internal open/short ckt or switches out of adjustment
Replace flap PDU sw box No. 1 and/or No. 2 (27-51-12)
A/C wiring fault
Repair wiring

M1 (XX) 22 611

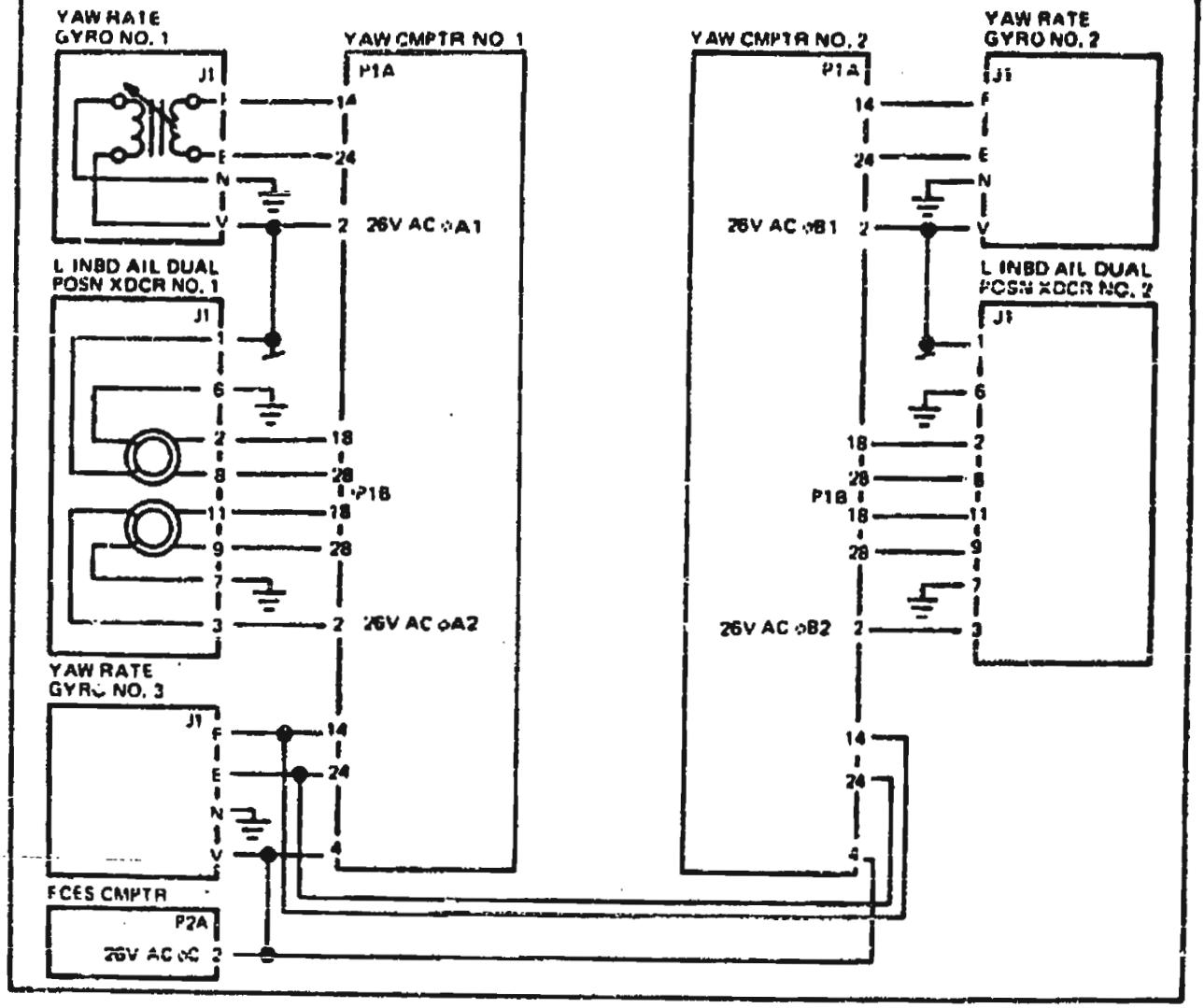
Yaw SAS System Faults
Figure 104 (Sheet 18)

R EFFECTIVITY: ALL

R
001B

9 CONTINUED

CKT #1 YAW CMPTR NO. 1 AND NO. 2 BASIC INPUTS (REF 22-15-00, SCHEM 2, 3)

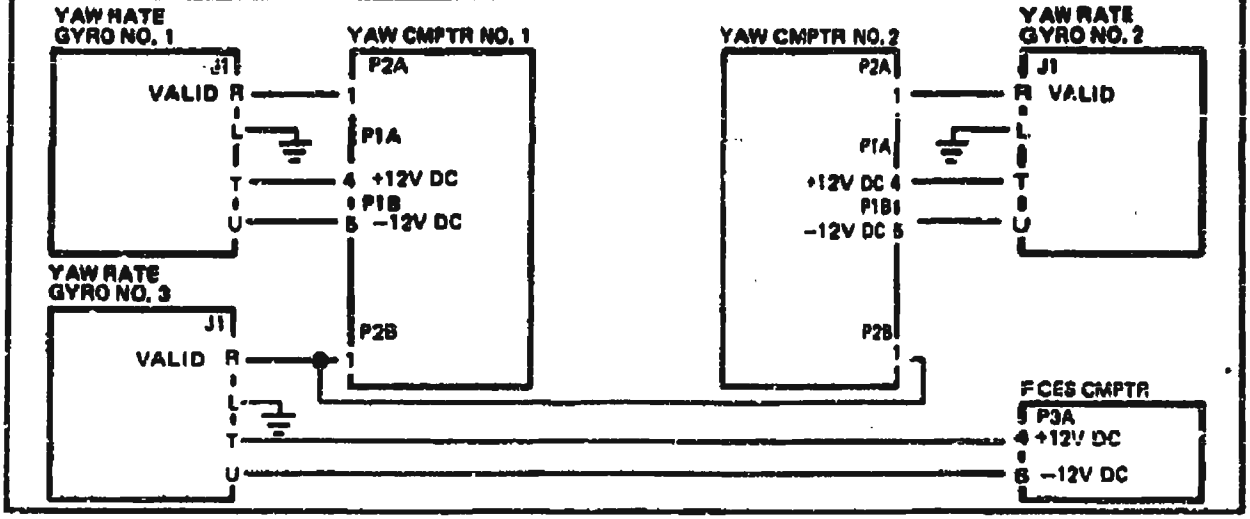


M1-0001-22-612

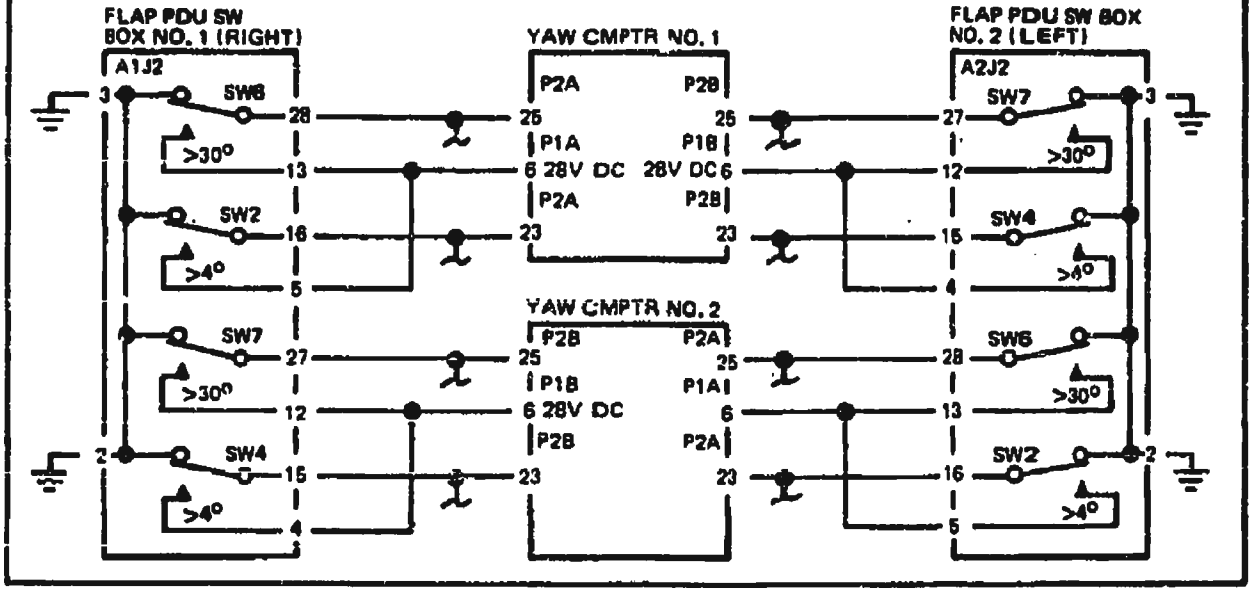
Yaw SAS System Faults
Figure 104 (Sheet 19)

9 CONTINUED

CKT #2 YAW RATE GYRO NO. 1, NO. 2, NO. 3
FIM CKT (REF. 22-15-00, SCHEM 2, 9)



CKT #3 FLAP POSITION SW INPUT
(REF. 22-15-00, SCHEM 8)



M1-0001-22-621

Yaw SAS System Faults
Figure 104 (Sheet 20)

10 BOTH YAW SAS FAIL LIGHTS COME ON DURING TURN COORDINATION. FLAPS UP

TWO FAULTS EXIST

All dual posn xdcr possible second fault → Troubleshoot system for two hidden faults. Use procedure described in fault [8]

11 BOTH YAW SAS FAIL LIGHTS COME ON DURING TURN COORDINATION. FLAPS DOWN

TWO FAULTS EXIST

Flap PDU switch box possible second fault → Troubleshoot system for two hidden faults. Use procedure described in fault [8]

12 RUDDER PEDALS REQUIRE TOO MUCH FORCE TO OPERATE RUDDER. RUDDER PEDALS OPERATE NORMAL WHEN YAW SAS 1 (2) IS TURNED OFF.

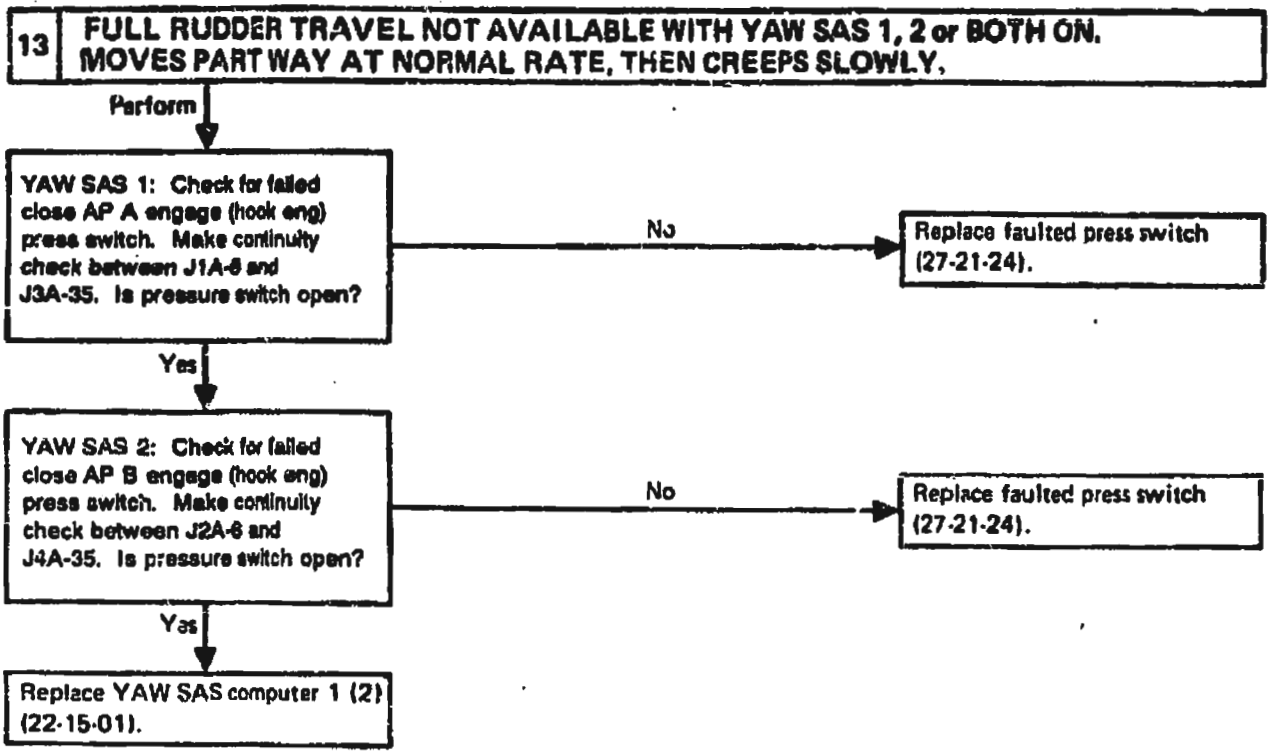
AP A (B) HYD SYS B (A) SOV failed open → Replace AP A (B) HYD SYS B (A) SOV (27-21-08)

NOTE
For FIRM codes followed by 02 use LRU in parenthesis ( ).

M1--0004-22-813

R Yaw SAS System Faults
R Figure 104 (Sheet 21)

EFFECTIVITY: ALL


13
FULL RUDDER TRAVEL NOT AVAILABLE WITH YAW SAS 1, 2 or BOTH ON. MOVES PART WAY AT NORMAL RATE, THEN CREEPS SLOWLY.
Perform
YAW SAS 1: Check for failed close AP A engage (hook eng) press switch. Make continuity check between J1A-6 and J3A-35. Is pressure switch open?
No
Replace faulted press switch (27-21-24).
Yes
YAW SAS 2: Check for failed close AP B engage (hook eng) press switch. Make continuity check between J2A-6 and J4A-35. Is pressure switch open?
No
Replace faulted press switch (27-21-24).
Yes
Replace YAW SAS computer 1 (2) (22-15-01).

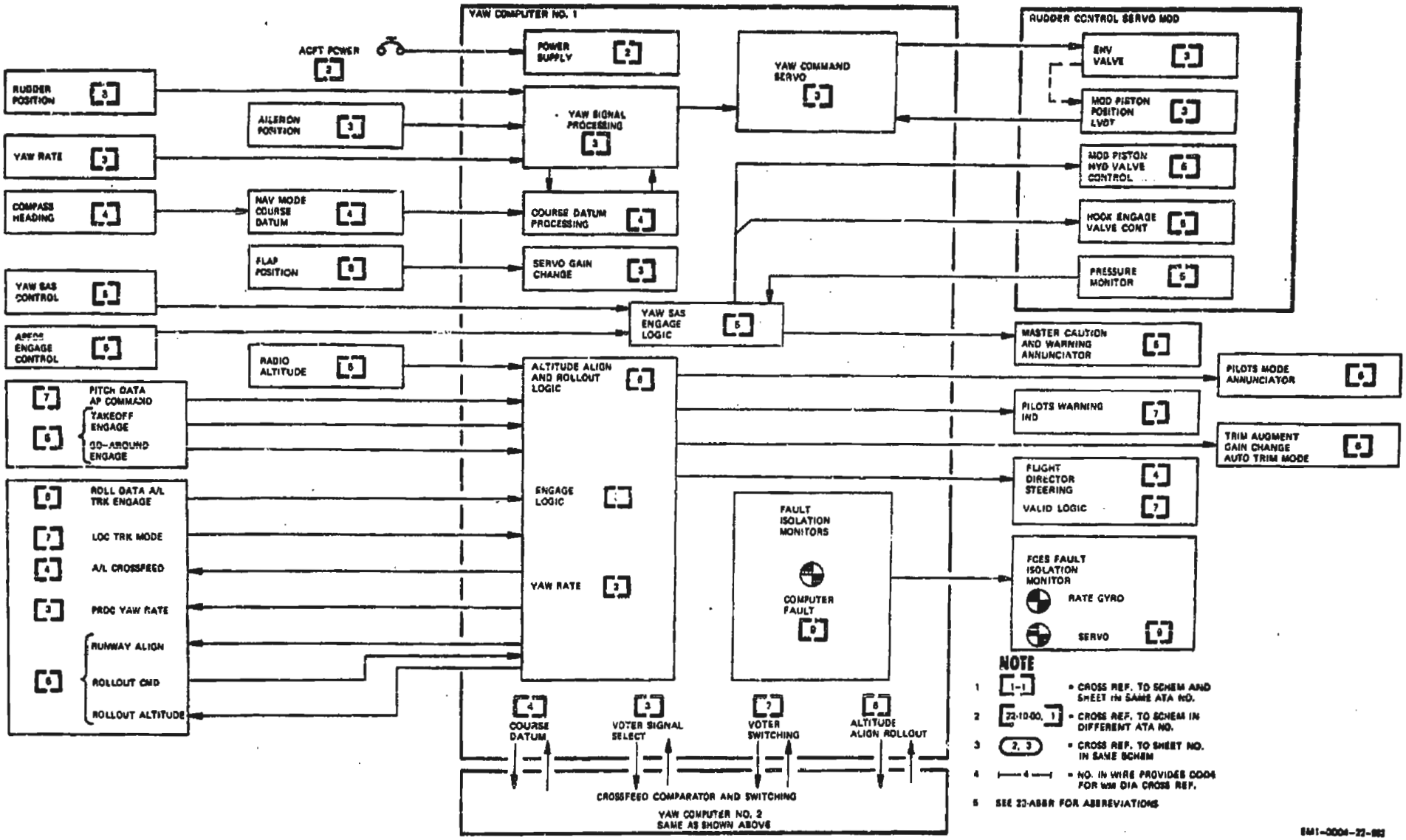
M1-0001-22-4062

R
R

Yaw SAS System Faults
Figure 104 (Sheet 22)

EFFECTIVITY: ALL

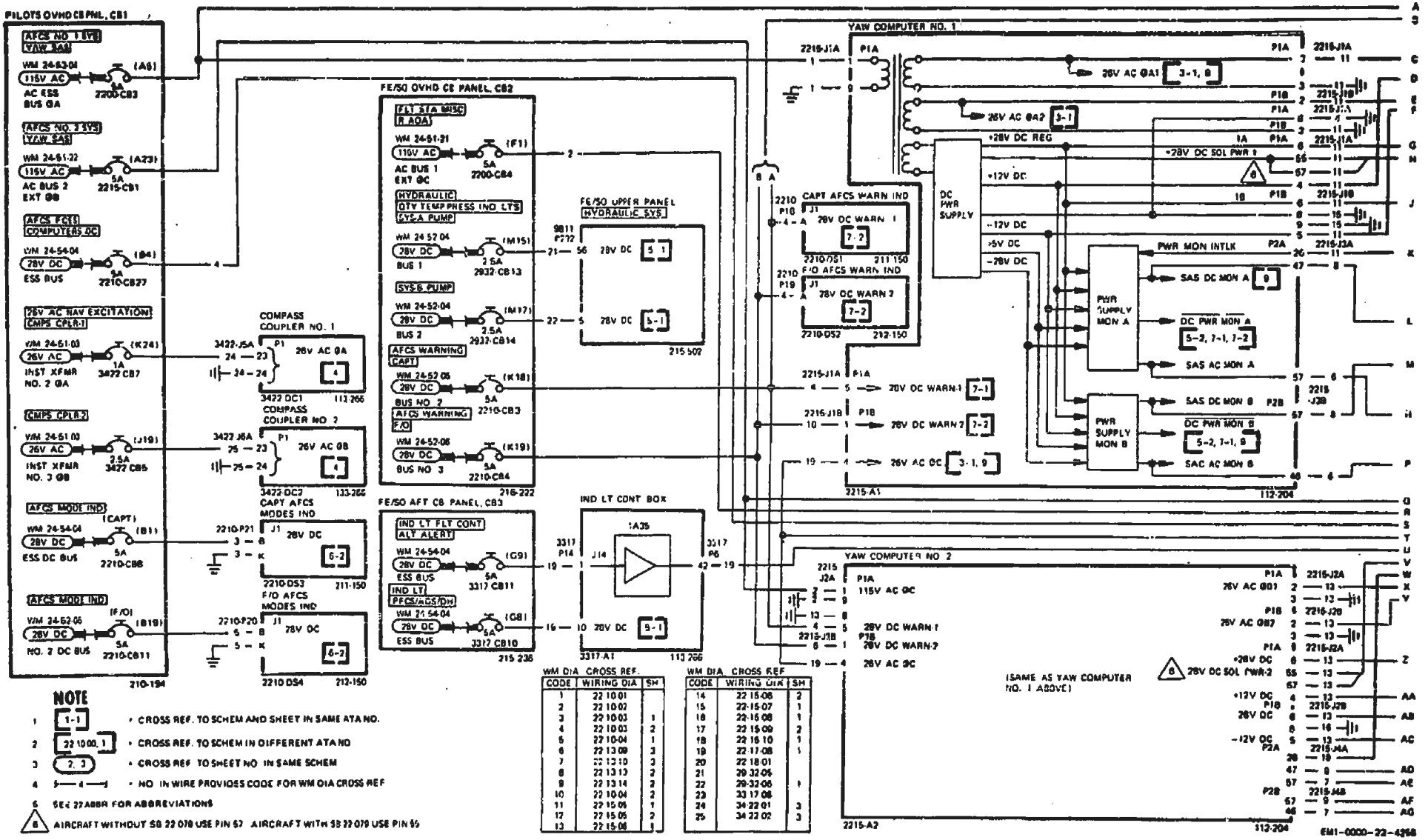
001B



R Yaw SAS Block Diagram
R SCHEM 1

EFFECTIVITY: ALL

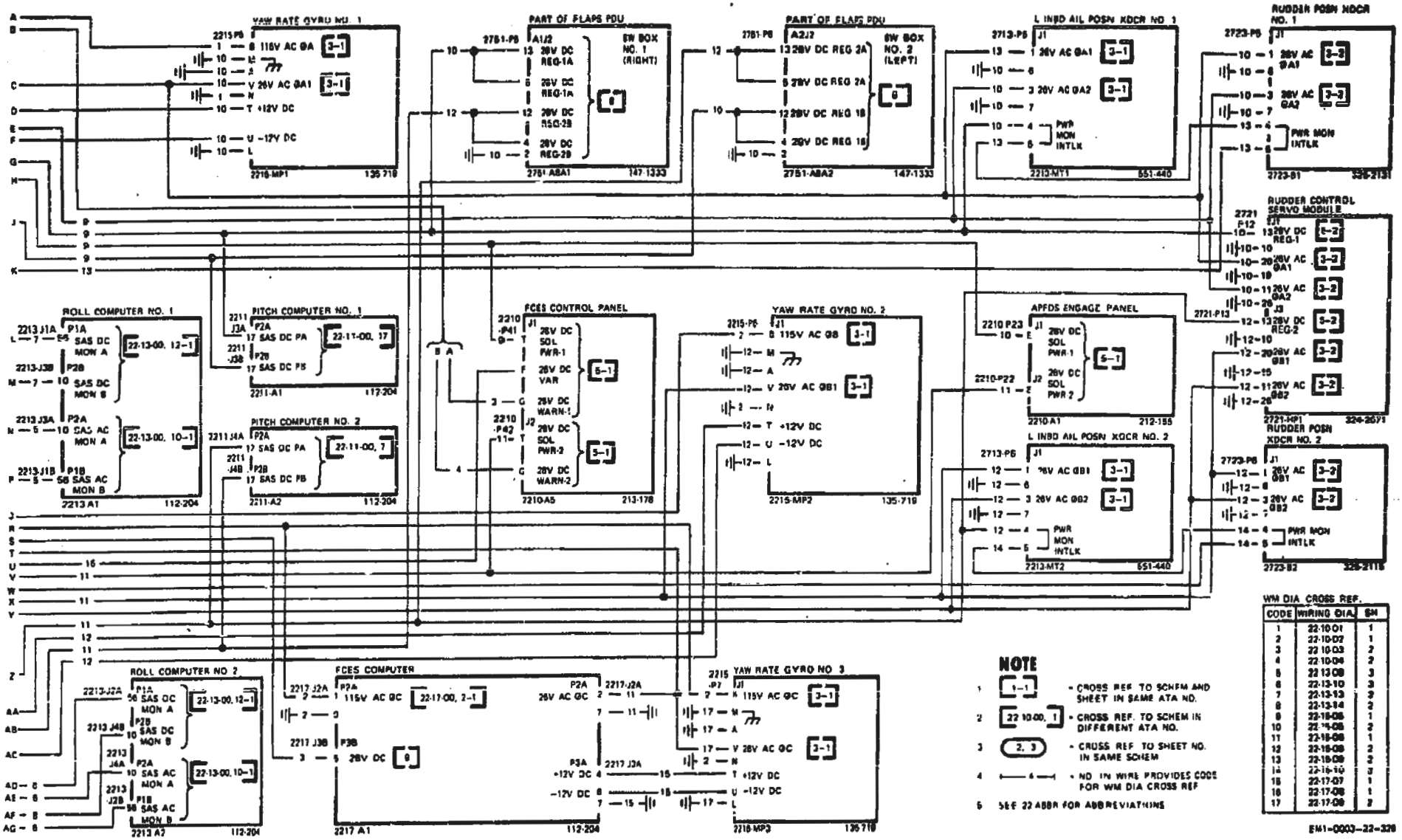
001B


PILOTS OVHD CB PNL, CB1
AFCS NO. 1 SYS YAW SAS
AFCS NO. 2 SYS YAW SAS
AFCS FCES COMPUTERS DC
26V AC NAV EXCITATION CMPS CPLR-1
CMPS CPLR-2
AFCS MODE IND (CAPT)
AFCS MODE IND (F/O)
FE/SO OVHD CB PANEL, CB2
FLT STA MISC R AOA
HYDRAULIC QTY TEMP PRESS IND LTS SYS A PUMP
SYS B PUMP
AFCS WARNING CAPT
BUS NO 2 AFCS WARNING F/O
FE/SO AFT CB PANEL, CB3
IND LT FLT CONT ALT ALERT
IND LT PFCS/AGS/DH
FE/SO UPPER PANEL HYDRAULIC SYS
IND LT CONT BOX
COMPASS COUPLER NO. 1
COMPASS COUPLER NO. 2
CAPT AFCS MODES IND
F/O AFCS MODES IND
YAW COMPUTER NO. 1
YAW COMPUTER NO 2
CAPT AFCS WARN IND
F/O AFCS WARN IND
DC PWR SUPPLY
PWR SUPPLY MON A
PWR SUPPLY MON B
PWR MON INTLK
SAS DC MON A
SAS AC MON A
SAS DC MON B
SAS AC MON B
DC PWR MON A
DC PWR MON B
(SAME AS YAW COMPUTER NO. 1 ABOVE)
NOTE
1 1-1 • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 22 10 00, 1 • CROSS REF. TO SCHEM IN DIFFERENT ATA NO
3 2, 3 • CROSS REF TO SHEET NO IN SAME SCHEM
4 • NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5 SEE 22 ABBR FOR ABBREVIATIONS
6 AIRCRAFT WITHOUT SB 22 078 USE PIN 67 AIRCRAFT WITH SB 22 079 USE PIN 66
WM DIA CROSS REF.
CODE WIRING DIA SH
1 22 10 01
2 22 10 02
3 22 10 03 1
4 22 10 03 2
5 22 10 04 1
6 22 13 09 3
7 22 13 10 2
8 22 13 13 2
9 22 13 14 2
10 22 10 04 2
11 22 15 05 1
12 22 15 05 2
13 22 15 06 2
WM DIA CROSS REF
CODE WIRING DIA SH
14 22 15 06 2
15 22-15-07 1
16 22-15-08 1
17 22 15 09 2
18 22 15 10 1
19 22 17 08 1
20 22 18 01
21 29 32 05
22 29-32-06 1
23 33 17 08
24 34 22 01 3
25 34 22 02 3

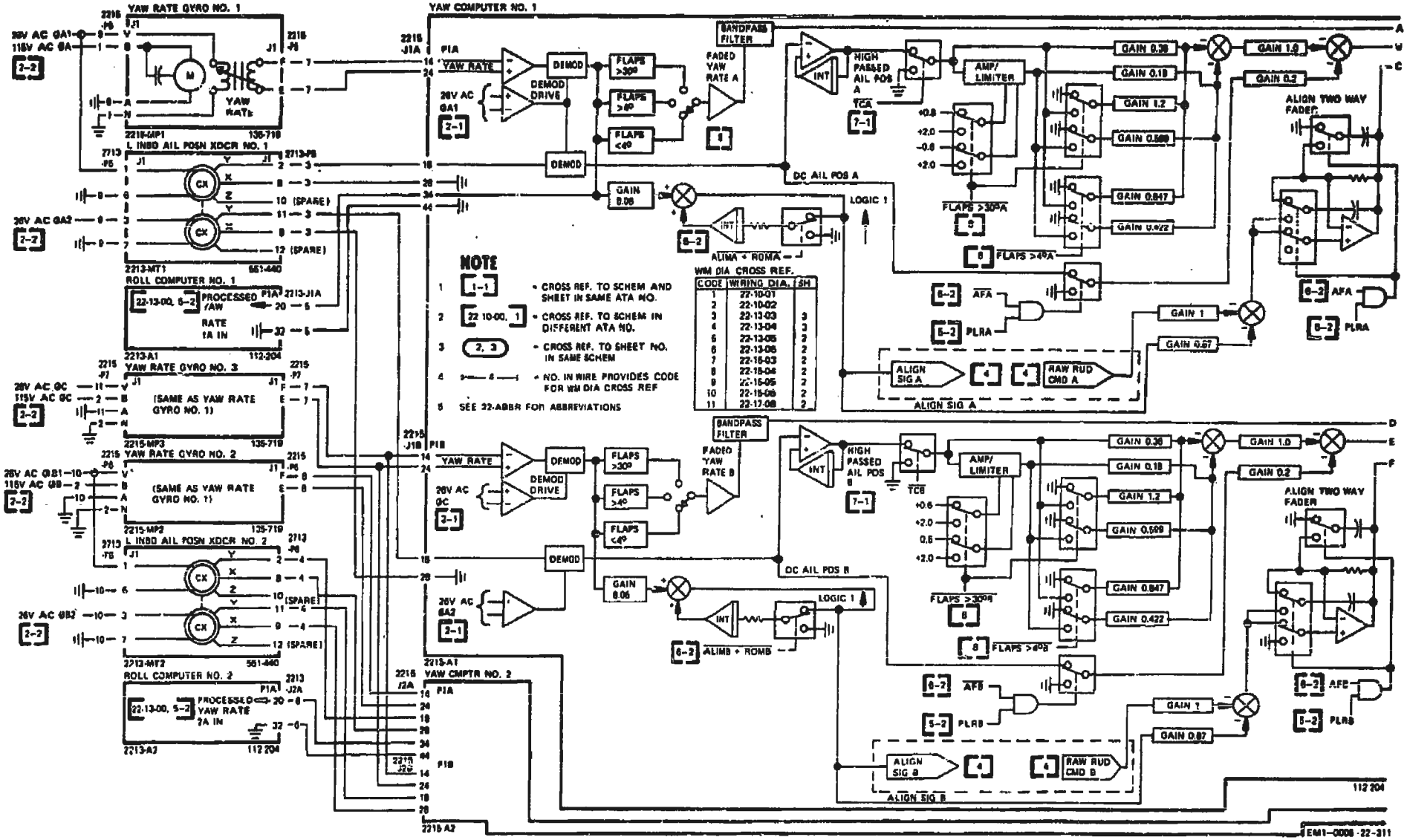
Yaw SAS Power Distribution Schematic
SCHEM 2 (Sheet 1)

EFFECTIVITY: ALL

001B

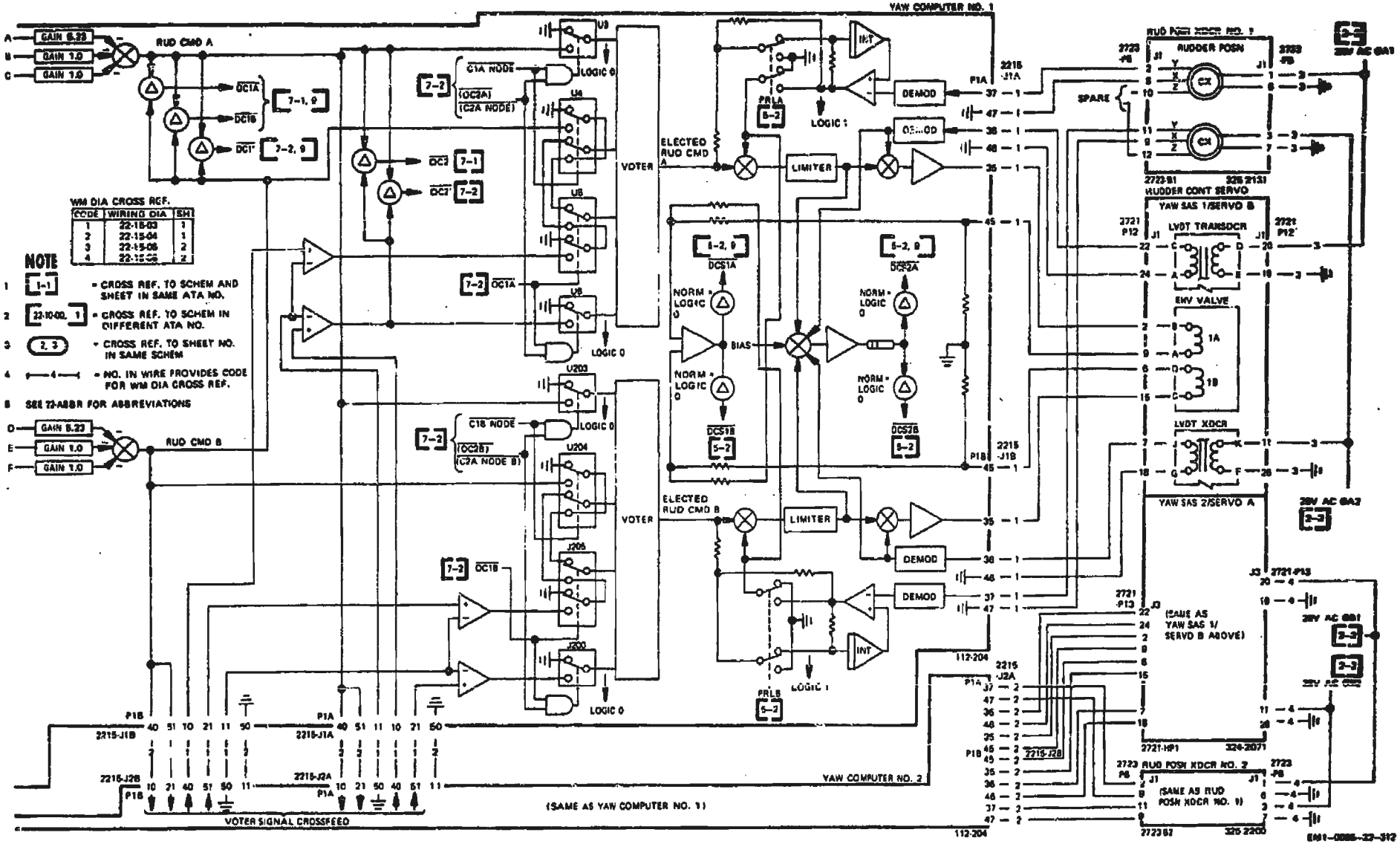


Yaw SAS Power Distribution Schematic
SCHEM 2 (Sheet 2)



Yaw SAS Basic Mode Signal Flow Schematic
SCHEM 3 (Sheet 1)

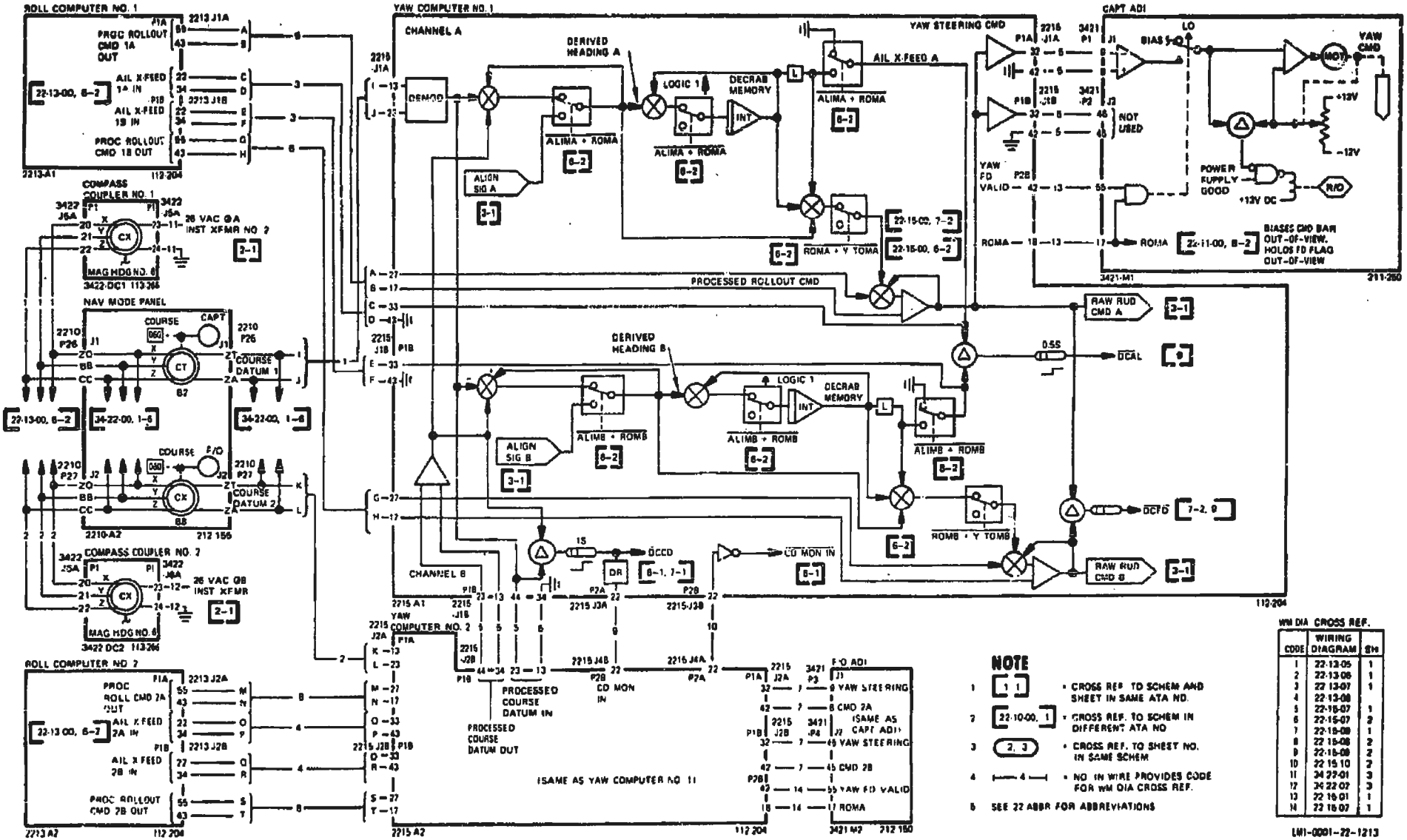
R EFFECTIVITY: ALL
R
001B



R Yaw SAS Basic Mode Signal Flow Schematic
R SCHEM 3 (Sheet 2)

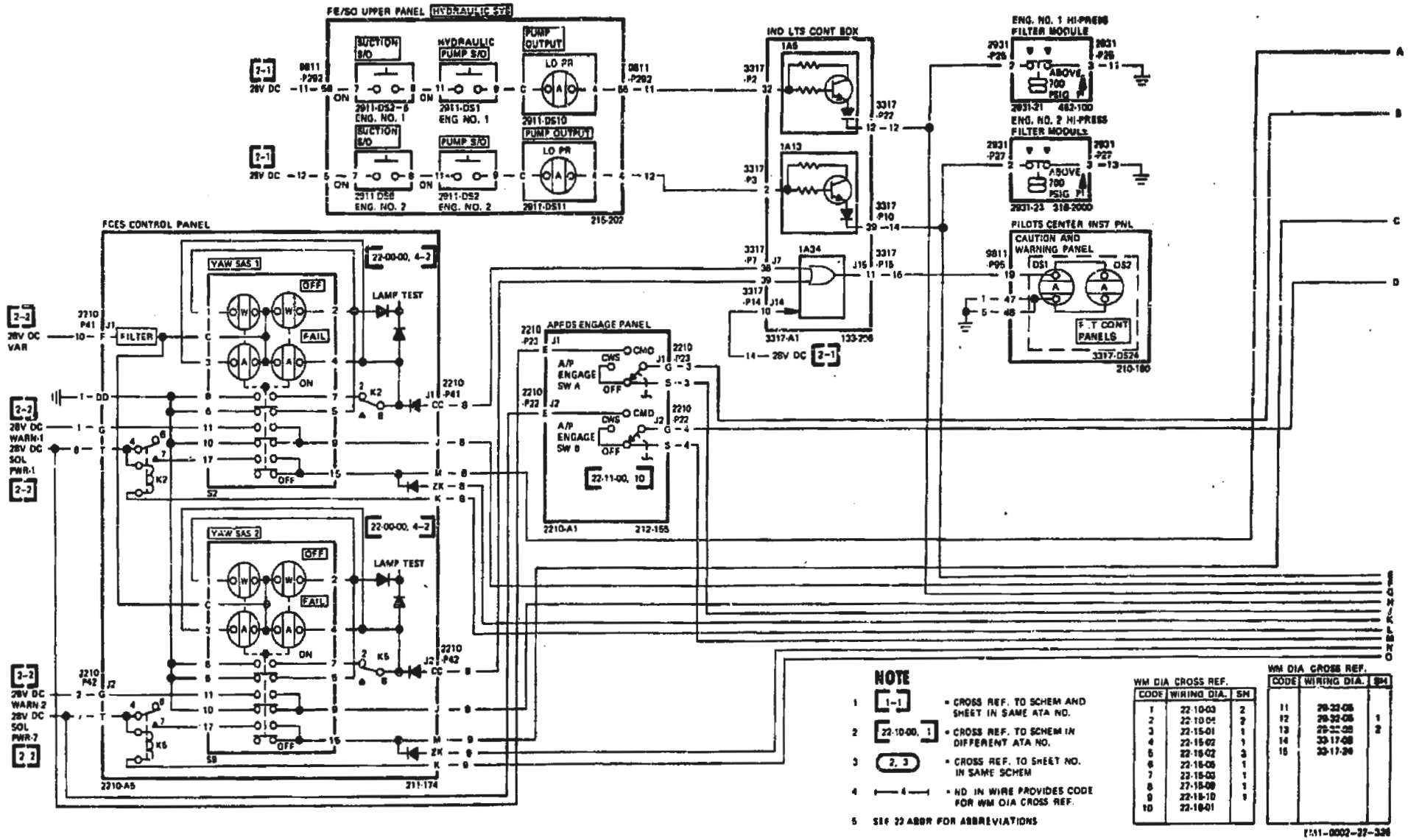
EFFECTIVITY: ALL

001B



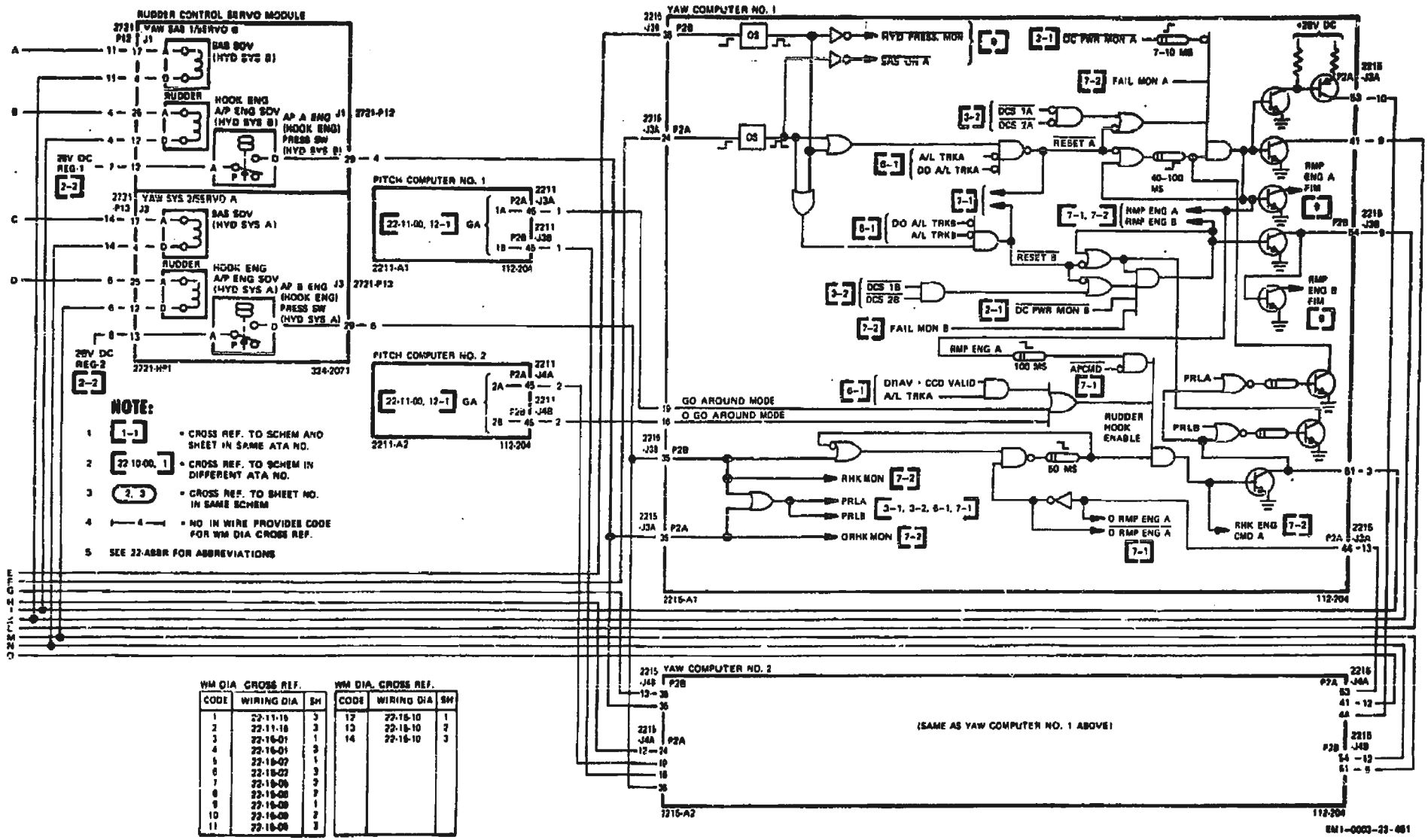
Yaw SAS Runway Align and Rollout Signal Flow Schematic
SCHEM 4

R EFFECTIVITY: ALL
R
001B



Yaw SAS Engage Logic Schematic
SCHEM 5 (Sheet 1)

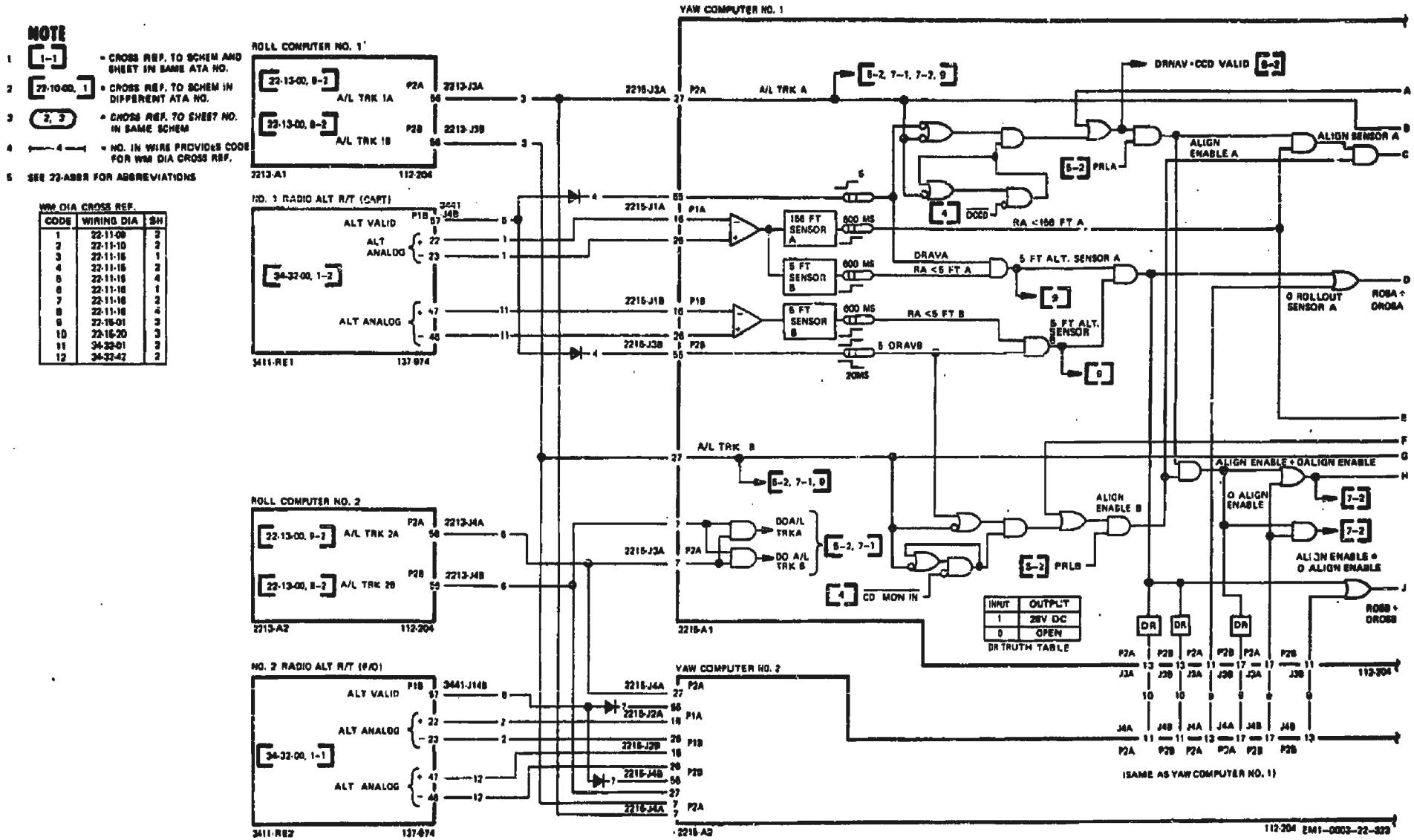
R EFFECTIVITY: ALL
R
001S


RUDDER CONTROL SERVO MODULE
YAW SAS 1/SERVO B
YAW SYS 2/SERVO A
BAS SOV (HYD SYS B)
BAS SOV (HYD SYS A)
RUDDER HOOK ENG A/P ENG SOV (HYD SYS B)
RUDDER HOOK ENG A/P ENG SOV (HYD SYS A)
AP A ENG (HOOK ENG) PRESS SW (HYD SYS B)
AP B ENG (HOOK ENG) PRESS SW (HYD SYS A)
28V DC REG-1
28V DC REG-2
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
YAW COMPUTER NO. 1
YAW COMPUTER NO. 2
(SAME AS YAW COMPUTER NO. 1 ABOVE)
RVD PRESS MON
SAS ON A
DC PWR MON A
FAIL MON A
DCS 1A / DCS 2A
RESET A
A/L TRKA
DO A/L TRKA
RMP ENG A FIM
RMP ENG B FIM
RESET B
DCS 1B / DCS 2B
DC PWR MON B
FAIL MON B
RMP ENG A
DRAV + CCD VALID
A/L TRKA
GO AROUND MODE
O GO AROUND MODE
RUDDER HOOK ENABLE
RHK MON
PRLA
PRLB
ORHK MON
O RMP ENG A
RHK ENG CMD A
NOTE:
1 CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 CROSS REF. TO SHEET NO. IN SAME SCHEM
4 NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS

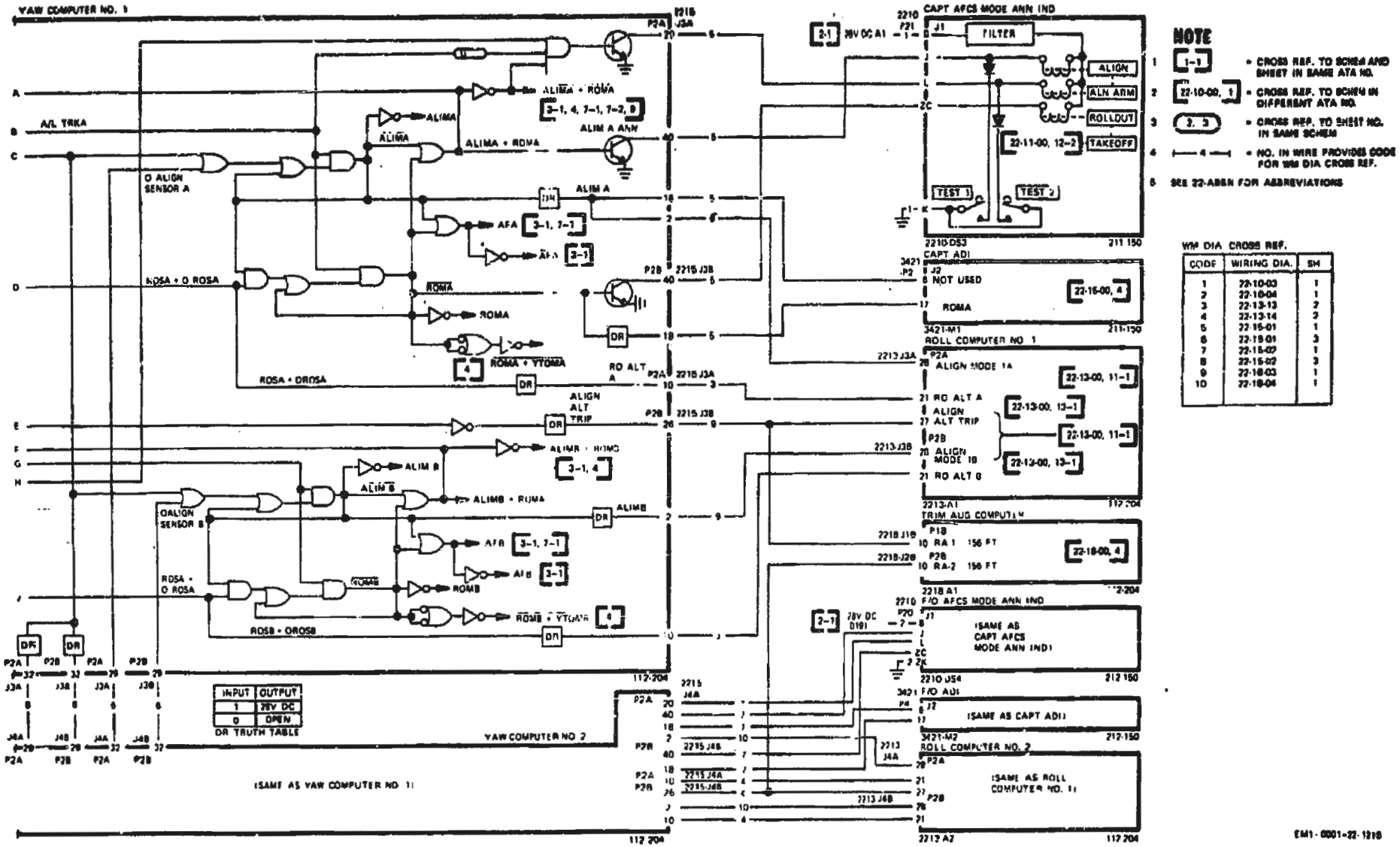
WM DIA. CROSS REF.			WM DIA. CROSS REF.		
CODE	WIRING DIA	SH	CODE	WIRING DIA	SH
1	22-11-16	3	12	22-16-10	1
2	22-11-18	3	13	22-16-10	2
3	22-16-01	1	14	22-16-10	3
4	22-16-01	3			
5	22-16-07	1			
6	22-16-07	3			
7	22-16-08	2			
8	22-16-08	2			
9	22-16-09	1			
10	22-16-09	2			
11	22-16-09	3			

Yaw SAS Engage Logic Schematic
SCHEM 5 (Sheet 2)

R EFFECTIVITY: ALL
R
0018

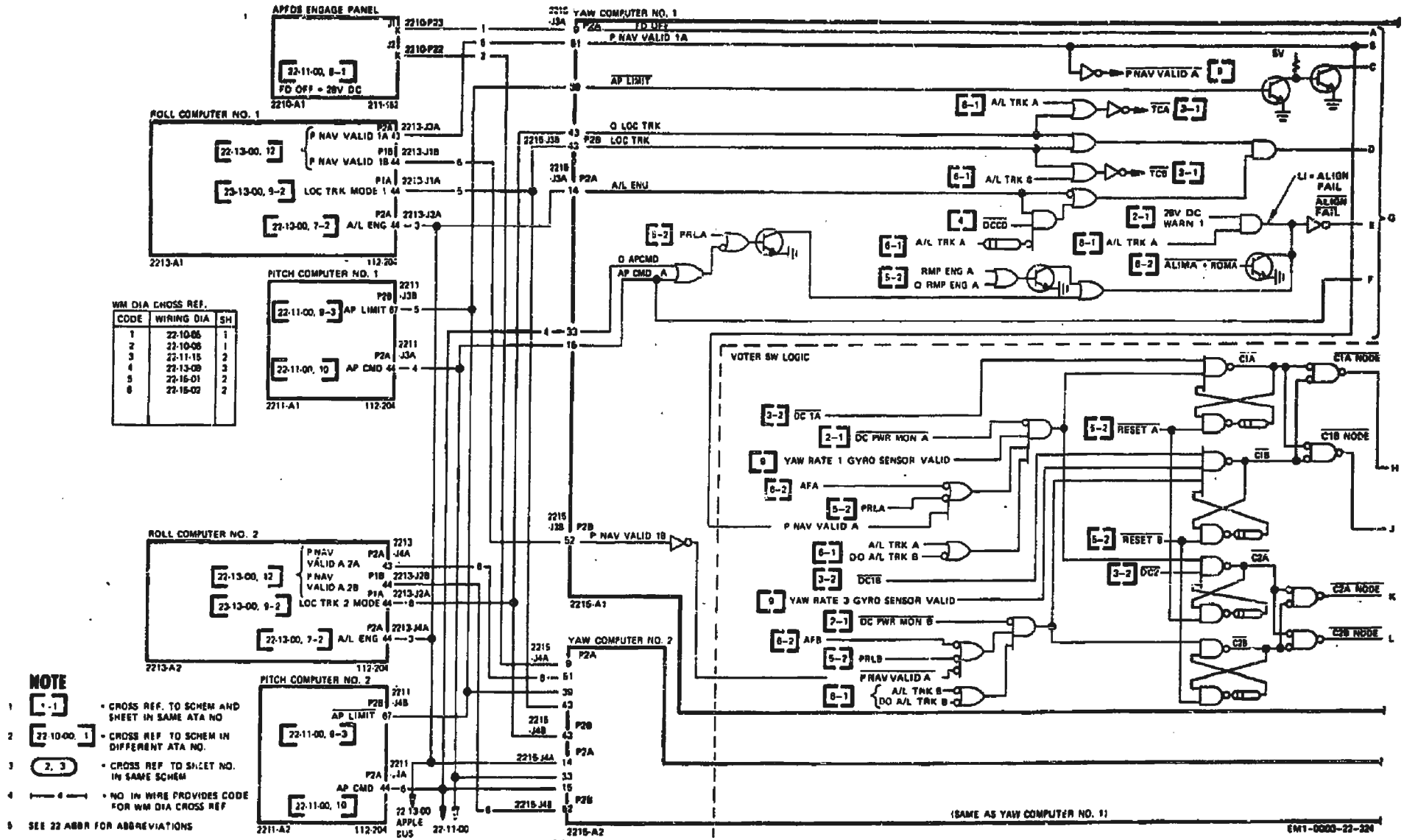

NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— • NO. IN WIRE PROVIDES CODE FOR WIRE DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WIRE DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-11-09 | 2
2 | 22-11-10 | 2
3 | 22-11-15 | 1
4 | 22-11-15 | 2
5 | 22-11-16 | 4
6 | 22-11-16 | 1
7 | 22-11-16 | 2
8 | 22-11-16 | 4
9 | 22-15-01 | 3
10 | 22-15-20 | 3
11 | 34-32-01 | 2
12 | 34-32-42 | 2
ROLL COMPUTER NO. 1
22-13-00, 8-2 A/L TRK 1A P2A 2213-J3A
22-13-00, 8-2 A/L TRK 1B P2B 2213-J3B
2213-A1 112-204
NO. 1 RADIO ALT R/T (CAPT)
ALT VALID P1B 57 3441-J4B
ALT ANALOG + 22 - 23
34-32-00, 1-2
ALT ANALOG + 47 - 46
3441-RE1 137-074
ROLL COMPUTER NO. 2
22-13-00, 8-2 A/L TRK 2A P2A 2213-J4A
22-13-00, 8-2 A/L TRK 2B P2B 2213-J4B
2213-A2 112-204
NO. 2 RADIO ALT R/T (F/O)
ALT VALID P1B 57 3441-J14B
ALT ANALOG + 22 - 23
34-32-00, 1-1
ALT ANALOG + 47 - 46
3411-RE2 137-074
YAW COMPUTER NO. 1
2215-J3A P2A A/L TRK A
[5-2, 7-1, 7-2, 9]
DRNAV • CCD VALID [5-2]
ALIGN ENABLE A
ALIGN SENSOR A
[5-2] PRLA
4 DCCD
RA ≤ 150 FT A
150 FT SENSOR A 600 MS
5 FT SENSOR B 600 MS
DRAVA
RA ≤ 5 FT A
5 FT ALT. SENSOR A
[9]
2215-J1A P1A
2215-J1B P1B
2215-J3B P2B
RA ≤ 5 FT B
5 DRAVB
20MS
5 FT ALT. SENSOR B
[9]
A/L TRK B
[5-2, 7-1, 9]
ALIGN ENABLE • ALIGN ENABLE
ALIGN ENABLE B
0 ALIGN ENABLE
[7-2]
[7-2]
ALIGN ENABLE • 0 ALIGN ENABLE
DOA/L TRKA
DO A/L TRK B
[5-2, 7-1]
[5-2] PRLB
4 CD MON IN
INPUT | OUTPUT
1 | 28V DC
0 | OPEN
DR TRUTH TABLE
0 ROLLOUT SENSOR A
ROSA • OROSA
ROSB • OROSB
2215-A1
YAW COMPUTER NO. 2
2215-J4A P2A
2215-J2A P1A
2215-J2B P1B
2215-J4B P2B
2215-J4A P2A
2215-A2
(SAME AS YAW COMPUTER NO. 1)
112-204 EM1-0003-22-323

Yaw SAS Align Arm, Align, and Rollout Logic Schematic
SCHEM 6 (Sheet 1)



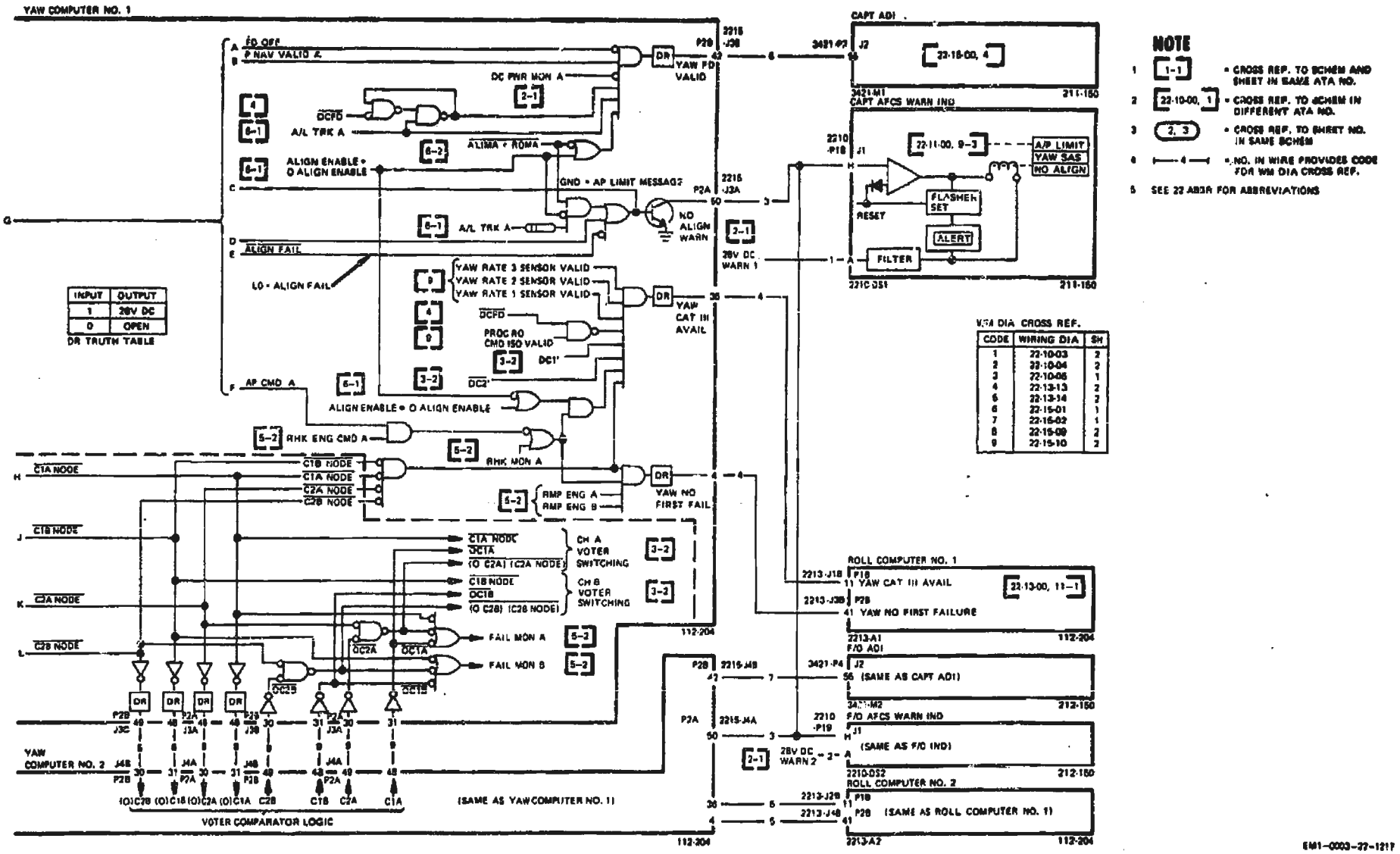
Yaw SAS Align Arm, Align, and Rollout Logic Schematic
SCHEM 6 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



Yaw SAS FD Valid, No Align, Yaw CAT IiI Avail, and Yaw No First Fail Logic Schematic
SCHEM 7 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



CODE	WIRING DIA	SH
1	22-10-03	2
2	22-10-04	2
3	22-10-05	1
4	22-13-13	2
5	22-13-14	2
6	22-15-01	1
7	22-15-02	1
8	22-15-09	2
9	22-15-10	2

NOTE

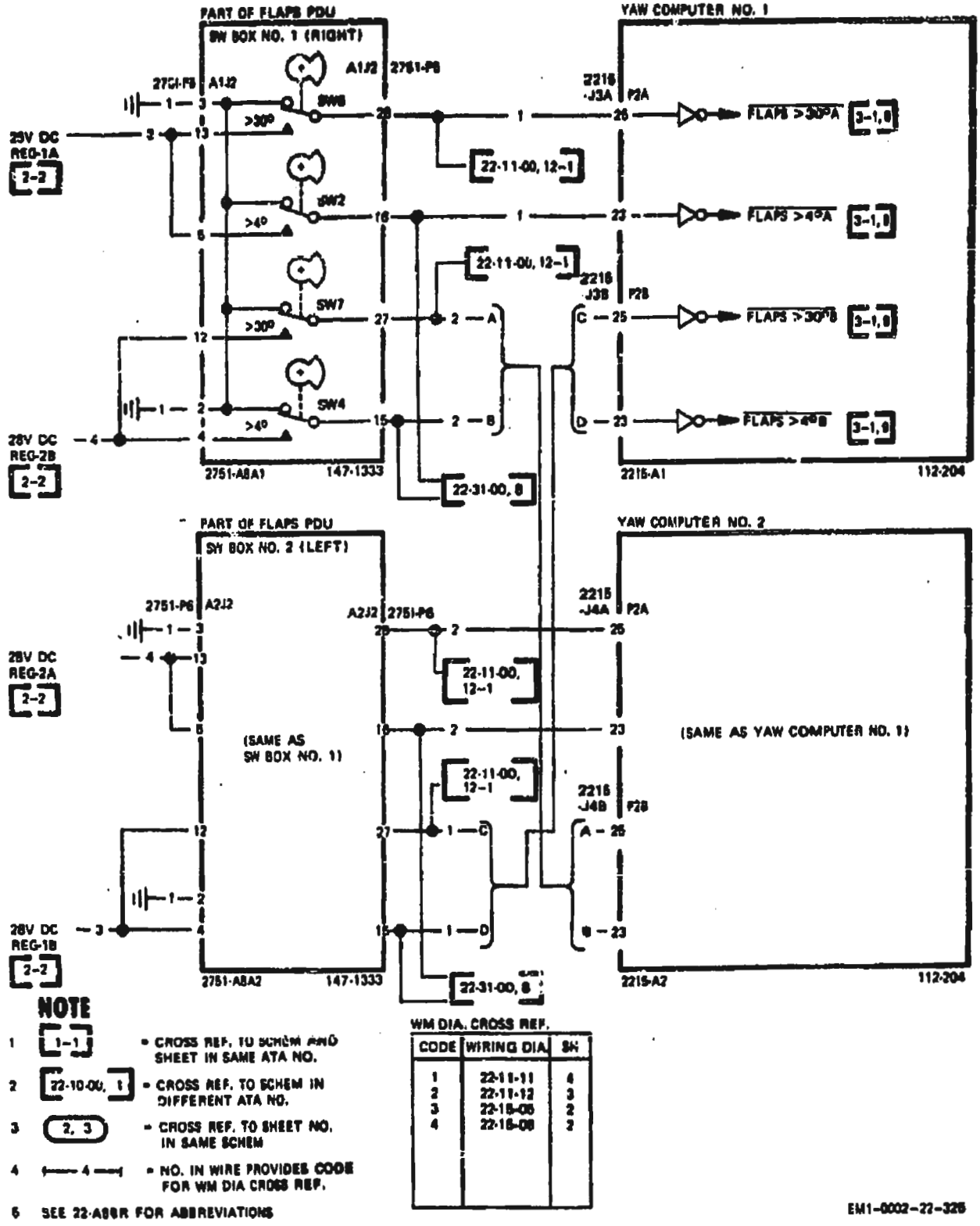
1. [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22 ABBR FOR ABBREVIATIONS

EM1-0003-22-1217

R Yaw SAS FD Valid, No Align, Yaw CAT III Avail,
R and Yaw No First Fail Logic Schematic
R SCHEM 7 (Sheet 2)

EFFECTIVITY: ALL

001B



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-A66R FOR ABBREVIATIONS

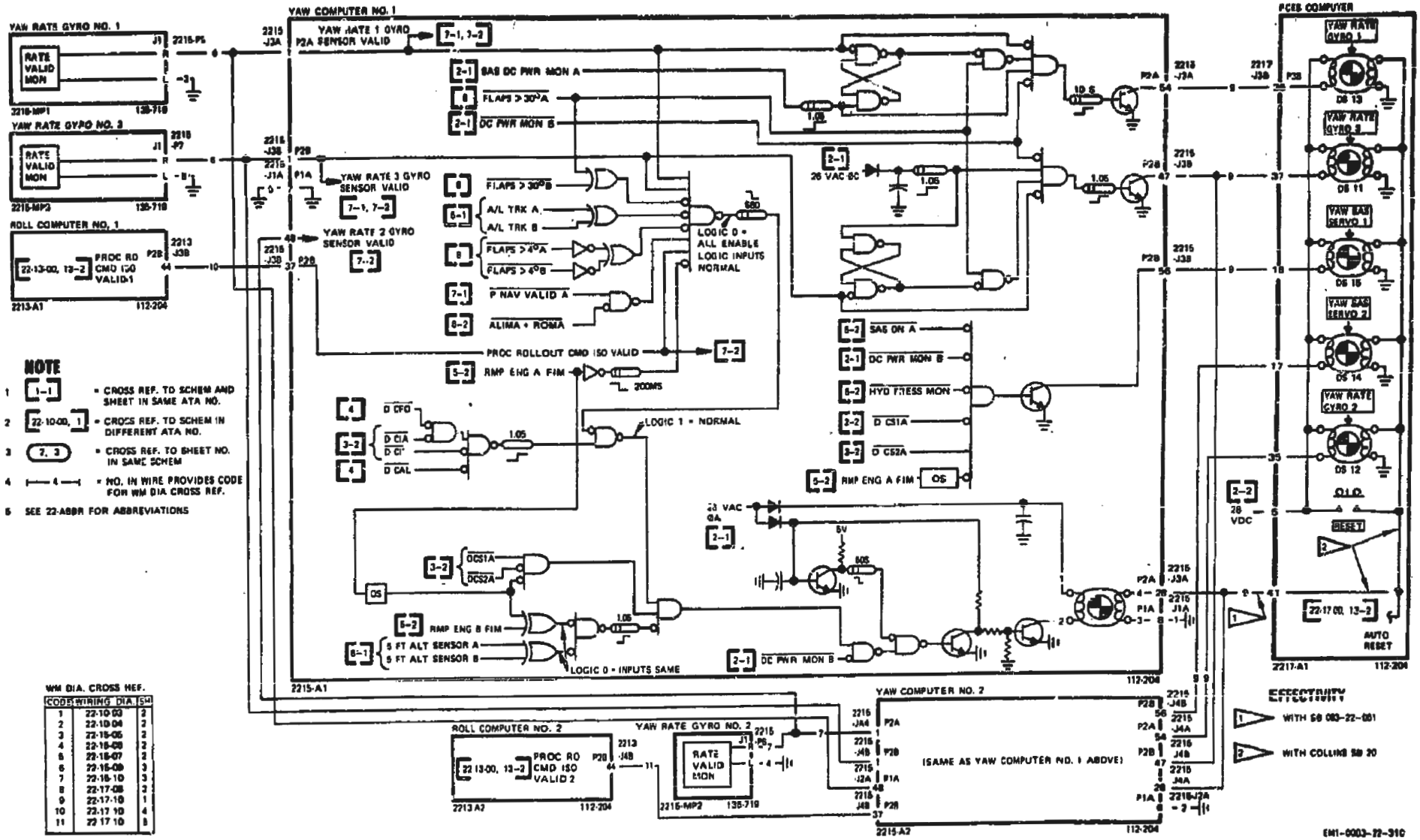
WM DIA. CROSS REF.

CODE	WIRING DIA	SH
1	22-11-11	4
2	22-11-12	3
3	22-15-05	2
4	22-15-09	2

EM1-0002-22-325

Yaw SAS Flap Position Logic Schematic
SCHEM 8

R EFFECTIVITY: ALL
R
001B



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (7, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA. CROSS REF.

CODE	WIRING DIA.	SH
1	22-10-03	2
2	22-10-04	2
3	22-15-05	2
4	22-15-06	2
5	22-15-07	2
6	22-15-08	3
7	22-15-10	3
8	22-17-08	3
9	22-17-10	1
10	22-17-10	4
11	22-17-10	5

Yaw SAS FIM Schematic
SCHEM 9

R
R
001B EFFECTIVITY: ALL

YAW STABILITY AUGMENTATION SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedures

21-00-00	Air Conditioning - Maintenance Practices
22-01-00	Autopilot Flight Director System - Adjustment and Test
22-17-00	Flight Control Electronics System - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
27-21-00	Rudder Control System - Adjustment and Test
27-21-00	Rudder Control System - Fault Isolation
29-11-00	Hydraulic Power System - Maintenance Practices
33-17-00	Annunciator System - Fault Isolation
34-21-00	Attitude Reference System - Adjustment and Test
34-22-00	Magnetic Heading Reference System - Adjustment and Test
34-32-00	Radio Altimeter System - Adjustment and Test
R 34-43-00	Inertial Navigation System - Adjustment and Test

2. Equipment and Materials

Breakout Cable Assembly for Yaw Computer, G/ITEL No. 22-00-19 (See Figure 108, 22-12-37). (Two Required for System Oriented Fault Detection Test in Paragraph 3.)

3. Adjustment/Test

The yaw stability augmentation system (yaw SAS) operational test provided below requires that all autoflight system components and associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

(4) Verify that the following systems are on:

Autopilot flight director system (Ref. 22-01-00)

Flight control electronics system (Ref. 22-17-00)

Aileron control system (Ref. 27-11-00)

Rudder control system (Ref. 27-21-00)

Attitude reference system (Ref. 34-21-00)

Magnetic heading reference system (Ref. 34-22-00)

Radio altimeter system (Ref. 34-32-00)

R Inertial Navigation System (Ref. 34-43-00)

(5) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS

- YAW SAS (A5)

NO. 2 SYSTEMS

- YAW SAS (A23)

26 VAC NAV EXCITATION SURFACE POS IND

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

AFCS WARNING

CAPT (K18)

F/O (K19)

FLIGHT STATION MISC - R AOA (F1)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT/ALT ALERT (G9) is closed.

(6) On PFCS monitor/control panel, verify that all switchlights are on (latched in) with no legend annunciated.

B. Basic Yaw SAS Operational Test

(1) On FCES control panel, verify that YAW SAS 1 and 2 switchlights are on (latched in) with no FAIL legend annunciated.

(2) Release (out) YAW SAS 2 switchlight to OFF.

(3) Apply manual aileron input on either control wheel. Verify that surface position indicator indicates rudder deflection and that rudder pedals are not moving.

(4) Release YAW SAS 1 switchlight to OFF, and depress YAW SAS 2 switchlight to on.

(5) Apply manual aileron input on either control wheel. Verify that surface position indicator indicates rudder deflection and that rudder pedals are not moving.

(6) Depress YAW SAS 1 switchlight to on.

C. Latent Failure Verification Test

NOTE: The YAW SAS is fail-operative; therefore, the following test is required to determine if latent faults exist that would cancel the fail-operative status.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open the No. 1 SYSTEMS YAW SAS circuit breaker (A5) and verify that only the No. 1 YAW SAS FAIL legend is illuminated. If both No. 1 and No. 2 YAW SAS FAIL

lights illuminate it indicates that a fault exists in the No. 2 system. The probable defective component is YAW SAS COMPUTER NO. 2, YAW RATE GYRO NO. 2, or YAW RATE GYRO NO. 3.

(2) Close the No. 1 YAW SAS circuit breaker. Wait one minute, then cycle YAW SAS 1 and 2 switchlights off and on.

(3) On pilots overhead circuit breaker panel CB1, zone 210, open the No. 2 SYSTEMS YAW SAS circuit breaker (A23) and verify that only the No. 2 YAW SAS FAIL legend is illuminated. If both No. 1 and No. 2 YAW SAS FAIL lights illuminate, a fault exists in the No. 1 system. The probable defective component is YAW SAS COMPUTER NO. 1, YAW RATE GYRO NO. 1, or YAW RATE GYRO NO. 3.

(4) Close the No. 2 YAW SAS circuit breaker. Wait one minute, then cycle YAW SAS 1 and 2 switchlights off and on.

(5) On the Second Officers circuit breaker panel CB-2, zone 215, open the RIGHT AOA circuit breaker (F1). Verify that the NO. 1 and NO. 2 YAW SAS FAIL legends are not illuminated. If the No. 1 and No. 2 FAIL lights illuminate, a fault exists in the No. 1 or No. 2 YAW SAS system. The probable defective component is either YAW SAS COMPUTER NO. 1, YAW SAS COMPUTER NO. 2, YAW RATE GYRO NO. 1, or YAW RATE GYRO NO. 2.

NOTE: When the RIGHT AOA circuit breaker is opened, it is normal for FCES related No. 2 systems to "FAIL".

(6) Close the RIGHT AOA circuit breaker. If no abnormal condition is experienced in Steps C (1), (3), or (5), proceed to test completion.

If a YAW SAS failure is indicated, exchange or replace the suggested components. If the fault cannot be isolated by these means, refer to YAW STABILITY AUGMENTATION SYSTEM, FAULT ISOLATION, (22-15-00, page 101) for further troubleshooting.

NOTE: Two defective rate gyros will always produce dual YAW SAS failures.

D. Test Completion

(1) Turn off hydraulic power (Ref. 29-11-00).

(2) Turn off electrical power (Ref. 24-00-00).

4. System Oriented Fault Detection Test

A. The fault detection test procedure in Paragraph 5 is used in conjunction with the fault isolation procedure in Paragraph 6. When a malfunction is confirmed by the test, refer to the fault number in Paragraph 6 for appropriate fault isolation.

5. Yaw SAS Fault Detection Test

A. Preliminary Procedure

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that equipment cooling is on (Ref. 21-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00). Verify that hydraulic systems A, B and C indicate 3,000 psi nominal.

(4) On PFCS Panel, set switchlights as follows:

Switchlight	Position
RUDDER	On (dark)
AILERON L OUTBD	On (dark)
AILERON L INBD	On (dark)
AILERON R INBD	On (dark)
AILERON R OUTBD	On (dark)

R (5) On aircraft 001-017,
R on Flight Control Panel, set switchlights as follows:

Switchlight	Position
RUDDER LIMITER MECHANICAL MNL-PUSH	On (dark)

MECHANICAL ±8° - ±30°		±30°
HYDRAULIC OVRD-PUSH		On (dark)

R (5) On aircraft 018-999,
R on Flight Control Panel, set HYDRAULIC OVRD-PUSH
R switchlight to on (dark)

(6) Ensure that both yaw computers are installed in avionics rack.

(7) Ensure that the following circuit breakers are closed:

PILOTS OVHD CB PNL CB 1

YAW SAS NO. 1 (A5)

FCES COMPUTERS AC & L AOA (B5)

YAW SAS NO. 2 (A23)

INSTR XFMR NO. 3 (D27)

SURF POSN IND (J23)

ANN RESET (L9)

FE/SO OVHD CB PNL CB 2

R AOA (F1)

AFCS WARNING - CAPT (K18)

AFCS WARNING - F/O (K19)

RUDDER SERVO A (K12)

RUDDER SERVO B (K13)

RUDDER SERVO C (K14)

RUDDER FUSING SYSTEM (L16)

F/E IND LT TEST (H1)

F/E IND LT TEST (H2)

F/E IND LT TEST (H3)

F/E IND LT TEST (H4)

F/E IND LT TEST (H5)

PILOTS IND LT TEST (H8)

PILOTS IND LT TEST (H9)

PILOTS IND LT TEST (H10)

FE/SO AFT CB PNL CB 3

PFCS ADS/DH (G8)

FLT CONT ALT ALERT (G9)

(8) On pilots overhead panel, depress WARNING CAUTION ADVISORY TEST switch to TEST and observe the following:

(a) On FCES panel, verify that YAW SAS 1 and 2 switchlights indicate OFF and FAIL.

(b) On PFCS panel, verify that the following legends are on:

Switchlight	Legend ON
RUDDER	Red
AILERON L OUTBD	OFF and crosshatched section
AILERON L INBD	OFF and crosshatched section
AILERON R INBD	OFF and crosshatched section
AILERON R OUTBD	OFF and crosshatched section

(c) On flight control panel, verify that following legends are on:

Switchlight	Legend ON
RUDDER LIMITER	
MECHANICAL (001-017 only)	MNL-PUSH
MECHANICAL (001-017 only)	±8° - ±30°
HYDRAULIC	OVRD-PUSH

(9) On pilots overhead panel, depress WARNING CAUTION ADVISORY TEST switch to OFF. All legends turned ON in Steps A(8)(a) thru A(8)(c) will go out, except RUDDER LIMITER MECHANICAL ±30° legend on aircraft 001-017.

R

(10) On FCES control panel, set both YAW SAS switchlights to OFF, and wait 1 minute before performing Step A(11) (next step).

(11) Turn manual ROLL trim wheel until AIL trim indicator on surface position indicator (SPI) reads zero.

(12) Turn manual YAW trim wheel until RUD trim indicator of SPI reads zero.

(13) Set flaps to zero.

(14) Center control wheel (approximately). Verify that L and R inboard, and L and R outboard ailerons are in neutral position.

B. Turn ON

(1) On FCES control panel, set both YAW SAS switchlights to on (dark). Verify that YAW SAS 1 and 2 switchlight FAIL legends are not illuminated.

(2) The rudder shall remain centered.

(3) On pilots center instrument panel, reset FLT CONT PNL legend if on.

C. Turn Coordination Dual Channel-Flap 0-Degrees Test

(1) Rotate either control wheel full clockwise (CW), then full counterclockwise (CCW) and observe the following:

(a) On SPI, RUD indicator moves right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 1 and 2 switchlights shall not indicate FAIL.

(2) Center the control wheel, and push either CAPT or F/O rudder pedal for full right rudder and hold. Release rudder pedal, and push either rudder pedal for full left rudder and hold. On FCES panel, YAW SAS 1 and 2 switchlights shall not indicate FAIL.

(3) Return rudder pedals to neutral (centered).

D. Turn Coordination Single Channel - Flap 0-Degrees Test

(1) On FCES control panel, set YAW SAS 2 switchlight to OFF. The rudder shall remain centered.

(2) On pilots overhead circuit breaker panel CB1, open YAW SAS (A23) circuit breaker.

(3) Rotate either control wheel full CW then full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 1 switchlight shall not indicate FAIL.

(4) Close A23 circuit breaker, and wait one minute before performing Step D(5) (next step).

(5) On FCES panel, set YAW SAS 2 switchlight to on, and YAW SAS 1 switchlight to OFF. The rudder shall remain centered.

(6) On pilots overhead circuit breaker panel CB1, open YAW SAS (A5) circuit breaker.

(7) Rotate either control wheel full CW, the full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 2 switchlight shall not indicate FAIL.

(8) Close A5 circuit breaker, and wait one minute before performing Step D(9) (next step).

(9) On FCES panel, set YAW SAS 1 switchlight to ON.

E. Turn Coordination Dual Channel - Flap 4-Degrees Test

(1) Set flaps to 4 degrees.

(2) Rotate either control wheel full CW, then full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 1 and 2 switchlights shall not indicate FAIL.

(3) Rotate control wheel to neutral (centered).

F. Turn Coordination Single Channel - Flap 4-Degrees Test

(1) On FCES control panel, set YAW SAS 2 switchlight to OFF. Ensure flaps are set to 4 degrees.

(2) On pilots overhead circuit breaker panel CB1, open YAW SAS (A23) circuit breaker.

(3) Rotate either control wheel full CW, the full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 1 switchlight shall not indicate FAIL.

(4) Return control wheel to centered position.

(5) Close A23 circuit breaker, and wait one minute before performing Step F(6) (next step).

(6) On FCES panel, set YAW SAS 2 switchlight to on, and YAW SAS 1 switchlight to OFF.

(7) On pilots overhead circuit breaker panel CB1, open YAW SAS (A5) circuit breaker.

(8) Rotate either control wheel full CW, then full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up

(c) On FCES panel, YAW SAS 2 switchlight shall not indicate FAIL.

(9) Return control wheel to center position.

(10) Close A5 circuit breaker, and wait one minute before performing Step F(11) (next step).

(11) On FCES panel, set YAW SAS 1 switchlight to on.

G. Turn Coordination Dual Channel - Flap 33-Degrees Test

(1) Set flaps to 33 degrees.

(2) Rotate either control wheel full CW, then full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 1 and 2 switchlights shall not indicate FAIL.

(3) Rotate control wheel to neutral (centered).

H. Turn Coordination Single Channel - Flap 33-Degrees Test

(1) On FCES control panel, set YAW SAS 2 switchlight to OFF. Ensure flaps are set to 33 degrees.

(2) On pilots overhead circuit breaker panel CB1, open YAW SAS (A23) circuit breaker.

(3) Rotate either control wheel full CW, then full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then to left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 1 switchlight shall not indicate FAIL.

(4) Return control wheel to centered position.

(5) Close A23 circuit breaker, and wait one minute before performing Step H(6) (next step).

(6) On FCES panel, set YAW SAS 2 switchlight to on, and YAW SAS 1 switchlight to OFF.

(7) On pilots overhead circuit breaker panel CB1, open YAW SAS (A5) circuit breaker.

(8) Rotate either control wheel full CW, then full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) On FCES panel, YAW SAS 2 switchlight shall not indicate FAIL.

(9) Return control wheel to centered position.

(10) Close A5 circuit breaker and wait one minute before performing Step H(11) (next step).

(11) On FCES panel, set YAW SAS 1 switchlight to on.

I. Rudder Turn Coordination Crossfeeds Test

(1) On FE/SO overhead circuit breaker panel CB2, open R-AOA (F1) circuit breaker. If either YAW SAS switchlight indicates FAIL, recycle the appropriate YAW SAS switchlight to OFF then on.

(2) Rotate either control wheel full CW, then full CCW and observe the following:

(a) On SPI, RUD indicator moves to right, then left (5-11 degrees).

(b) Left AIL indicator moves down, then up.

(c) YAW SAS switchlights shall not indicate FAIL.

(3) Return control wheel to centered position.

(4) Close F1 circuit breaker.

J. Rate Gyro Channels 1 and 2 Tests

(1) On FCES panel, set YAW SAS 1 switchlight to on and YAW SAS 2 switchlight to OFF.

(2) On pilots overhead circuit breaker panel CB1, open YAW SAS (A23) circuit breaker.

(3) Open gyro access door in galley ceiling (zone 135) and remove rate gyro No. 1 with cable connected. Rotate gyro clockwise rapidly. On FCES panel, YAW SAS 1 switchlight shall indicate FAIL.

(4) Reinstall rate gyro No. 1.

(5) Cycle YAW SAS 1 switchlight to OFF, then on. The FAIL legend shall go out.

(6) Remove rate gyro No. 3 from ceiling with cable connected. Rotate gyro clockwise rapidly. YAW SAS 1 switchlight shall indicate FAIL.

(7) Close A23 circuit breaker and wait one minute before performing Step J(8) (next step).

(8) On FCES panel, set YAW SAS 2 switchlight to on and YAW SAS 1 switchlight to OFF.

(9) On pilots overhead circuit breaker panel CB1, open YAW SAS (A5) circuit breaker.

(10) Rotate rate gyro No. 3 counterclockwise rapidly. On FCES panel, YAW SAS 2 switchlight shall indicate FAIL.

(11) Reinstall rate gyro No. 3.

(12) Cycle YAW SAS 2 switchlight to OFF, then on. The FAIL legend shall go out.

(13) Remove rate gyro No. 2 from ceiling with cable connected. Rotate gyro clockwise rapidly. YAW SAS 2 switchlight shall indicate FAIL.

(14) Reinstall rate gyro No. 2 and close gyro access door.

(15) Close A5 circuit breaker opened and wait one minute before performing Step J(16) (next step).

(16) Cycle YAW SAS 2 switchlight to OFF, then on. The FAIL legend shall go out.

(17) Repeat Steps (1) through (16) at zero degree flaps, and then at 10 degrees flaps.

K. Test Completion

(1) Turn off hydraulic power (Ref. 29-11-00).

(2) Turn off electrical power (Ref. 24-00-00).

6. Fault Isolation

A. General

R Table 501 is a summary of faults encountered when performing the Faults Detection Test. It also lists the fault number in Paragraph 6B for the appropriate fault isolation procedure. Dashed lines separate faults in Paragraph 6B.

R Since no fault isolation system can cover every potential fault, reference to applicable fault isolation schematics are given in Table 502. For fault isolating aircraft wiring use tables on schematics for a listing of applicable wiring diagrams.

R For YAW SAS auto reset fault isolation, refer to Table 503.

R YAW SAS System Fault Isolation Summary
Table 501

TEST REF.	FAULT	FAULT NO.
5A(8)	One or all legends on FCES panel, and/or PFCS panel and/or Flight Control panel do not illuminate during LIGHT test.	(1)
5B(1)-1	Both YAW SAS FAIL at turn on.	(2)
5B(1)-2	YAW SAS 1 FAIL at turn on.	(3)
5B(1)-3	YAW SAS 2 FAIL at turn on.	(4)
5B(2)	Rudder does not remain centered at turn on.	(5)
5C(1)	YAW SAS 1 and/or 2 FAIL when rotating control wheel, flaps at 0 deg., dual channel.	(6)
5C(2)	YAW SAS 1 and/or 2 FAIL when pushing rudder pedal, flaps at 0 deg., dual channel.	(7)
5D(1)	Rudder does not remain centered, flaps at 0 deg., only YAW SAS 1 on.	(8)
5D(3)	YAW SAS 1 FAIL and/or rudder does not respond (move) properly when rotating control wheel, flaps at 0 deg., only YAW SAS 1 on.	(9)
5D(5)	Rudder does not remain centered, flaps at 0 deg., only YAW SAS 2 on.	(10)
5D(7)	YAW SAS 2 FAIL and/or rudder does not respond (move) properly when rotating control wheel, flaps at 0 deg., only YAW SAS 2 on.	(11)
5E(2)	YAW SAS 1 and 2 FAIL when rotating control wheel, flaps at 4 deg., dual channel.	(12)
5F(3)	YAW SAS 1 FAIL when rotating control wheel, flaps at 4 deg., only YAW SAS 1 on.	(13)
5F(8)	YAW SAS 2 FAIL when rotating control wheel, flaps at 4 deg., only YAW SAS 2 on.	(14)

R YAW SAS System Fault Isolation Summary (Cont)
Table 501

TEST REF.	FAULT	FAULT NO.
5G(2)	YAW SAS 1 and 2 FAIL when rotating control wheel, flaps at 33 deg., dual channel.	(15)
5H(3)	YAW SAS 1 FAIL when rotating control wheel, flaps at 33 deg., only YAW SAS 1 on.	(16)
5H(8)	YAW SAS 2 FAIL when rotating control wheel, flaps at 33 deg., only YAW SAS 2 on.	(17)
5I(2)	YAW SAS 1 and/or 2 FAIL during turn coordination crossfeed test.	(18)
5J(3)	YAW SAS 1 does not FAIL when rotating rate gyro No. 1 during rate gyro test.	(19)
5J(6)	YAW SAS 1 does not FAIL when rotating rate gyro No. 3 during rate gyro test.	(20)
5J(10)	YAW SAS 2 does not FAIL when rotating rate gyro No. 3 during rate gyro test.	(21)
5J(13)	YAW SAS 2 does not FAIL when rotating rate gyro No. 2 during rate gyro test.	(22)
R	YAW SAS FAIL legend will not automatically reset after engines 1 and 2 start	Table 503

Yaw SAS Fault Isolation Diagrams
Table 502

	FIGURE NO.	TITLE
R	Figure 103	Yaw SAS Block Diagram Layout
R	SCHEM 1	Yaw SAS Power Distribution Schematic
R	SCHEM 2	Yaw SAS Basic Mode Signal Flow Schematic
R R	SCHEM 3	Yaw SAS Runway Align and Rollout Signal Flow Schematic
R	SCHEM 4	Yaw SAS Engage Logic Schematic
R R	SCHEM 5	Yaw SAS Mode Align Arm, Align, and Rollout Logic Schematic
R R	SCHEM 6	Yaw SAS FD Valid No Align, Yaw CAT III Avail, and Yaw No First Fail Logic Schematic
R	SCHEM 7	Yaw SAS Flap Position Logic Schematic
R	SCHEM 8	Yaw SAS FIM Logic Schematic

B. YAW SAS Faults

(1) Fault: One or all legends on FCES panel, and/or PFCS panel, and/or Flight Control panel do not illuminate during LIGHT test.

(a) Are switchlights on all pilots overhead panels dark?

Yes: Check for light control system (ILCB) fault (Ref. 33-17-00).

No: Go to Step (b).

(b) Are all switchlights on one panel dark?

Yes: Replace defective panel.

No: Replace defective switchlight lamp. If trouble still persists, replace panel.

---

(2) Fault: Both YAW SAS FAIL at turn on.

(a) Open gyro access door in galley ceiling (zone 135).

(b) Are YAW rate gyros (No. 1, 2 and 3) installed properly?

Yes: Go to Step (c).

No: Install properly (Ref. 22-15-02).

(c) Is each YAW rate gyro running? Determine by feeling gyro or listening for hum, etc.

Yes: Close gyro access door, and go to Fault (3) and/or (4).

No: Replace YAW rate gyro that is not running (Ref. 22-15-02).

---

(3) Fault: YAW SAS 1 FAIL at turn on.

(a) Open following circuit breakers:

PILOTS OVHD CB PNL CB1

YAW SAS (A5)

YAW SAS (A23)

FE/SO OVHD CB PNL CB2

R AOA (F1)

(b) Replace yaw computer No. 1 (Ref. 22-15-01).

(c) Close circuit breakers opened in Step (a).

(d) Set both YAW SAS switchlights to OFF.

(e) Wait one minute and set both YAW SAS switchlights to on.

(f) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (g).

No: Original yaw computer No. 1 was faulty.

(g) From Step (f). Open YAW SAS (A5) circuit breaker on CB1. Remove yaw computer No. 1 from FESC avionic rack 2 (Ref. 22-15-01). Measure the resistance to ground on the following yaw computer No. 1 shelf connector pins (all measurements should be greater than 40 ohms).

J1A-6

J1A-55

J1B-6

J3A-47

J3A-57

J3B-46

J3B-57

(h) Did all of the above readings show greater than 40 ohms?

Yes: Go to Step (x).

No: Go to Step (i) for all pins except J1A-55. For a ground on J1A-55, go to Step (u).

(i) From Step (h). Reinstall yaw computer No. 1, and close YAW SAS (A5) circuit breaker on CB1. Wait one minute, then open PITCH AND ROLL (A6) circuit breaker on CB1. On FESC avionic rack 2, remove pitch computer No. 1 (Ref. 22-11-01) and roll computer No. 1 (Ref. 22-13-01).

(j) Cycle YAW SAS 1 switchlight to OFF then on again.

(k) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Reinstall pitch and roll computers removed in Step (i) and then go Step (o).

No: Go to Step (l).

(l) From Step (k). Reinstall pitch computer No. 1 in FESC avionic rack 2.

(m) Cycle YAW SAS 1 switchlight to OFF then on again.

(n) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Replace pitch computer No. 1 (Ref. 22-11-01).

No: Replace roll computer No. 1 (Ref. 22-13-01).

(o) From Step (k). In hydraulic service center, disconnect flap power drive unit (PDU) connectors 2751-P5 and 2751-P6 from both flap PDU switchboxes.

(p) Cycle YAW SAS 1 switchlight to OFF then on again.

(q) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Reconnect both flap PDU connectors disconnected in Step (o) and go to Step (aa).

No: Go to Step (r).

(r) From Step (q). In hydraulic service center, reconnect flap PDU connector 2751-P5 to flap PDU switchbox No. 1.

(s) Cycle YAW SAS 1 switchlight to OFF then on again.

(t) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Replace flap PDU switchbox No. 1 (Ref. 27-51-12).

No: Replace flap PDU switchbox No. 2 (Ref. 27-51-12).

(u) From Step (h). On pilots overhead panel, remove FCES control panel (Ref. 22-10-07).

R (v) Again measure the resistance from yaw computer No. 1 pin J1A-55 (shelf connector) to ground (should
R be greater than 40 ohms).

R (w) Did the above reading show greater than 40 ohms?

Yes: Replace FCES control panel (Ref. 22-10-07), then replace yaw computer No. 1 (Ref. 22-15-01).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01), then replace yaw computer No. 1 (Ref. 22-15-01).

(x) From Step (h). On pilots overhead panel, replace FCES control panel (Ref. 22-10-07).

(y) Cycle YAW SAS 1 switchlight to OFF then on again.

(z) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (aa).

No: Original FCES panel was faulty.

(aa) From Step (q)or (z). Open YAW SAS (A5) circuit breaker, if not already done. Remove yaw computer No. 1 from FESC avionic rack 2, if not already done. Measure for continuity between yaw computer
R No. 1 shelf connector pin J1A-6 and J3A-26 (should be less than 40 ohms). Also ensure that there is no continuity between these points and ground.

(ab) Is there an open or ground between J1A-6 and J3A-26?

Yes: Go to Step (ac).

No: Go to Step (ae).

(ac) From Step (ab). On left wing, open access door 551AB. Remove connector from aileron dual position transducer No. 1 and measure for continuity between transducer pins 4 and 5. Also ensure that there is no continuity between these points and ground.

(ad) Is there an open or ground between aileron dual position transducer No. 1, pin 4 or 5?

Yes: Replace aileron dual position transducer No. 1 (Ref. 22-13-03). If a ground was present, replace yaw computer No. 1 (Ref. 22-15-01) in addition to aileron dual position transducer No. 1.

No: Reconnect connector to aileron dual position transducer No. 1 and close access door 551AB. On rudder, open access door 324CL and remove access panel 325DL. Replace rudder dual position transducer No. 1 (Ref. 22-15-03). If a ground was present, replace yaw computer No. 1 (Ref. 22-15-01) in addition to rudder dual position transducer No. 1.

(ae) From Step (ab). Open YAW SAS (A5) circuit breaker on CB1, if not already done. Replace yaw rate gyro No. 1 (Ref. 22-15-02).

(af) Close YAW SAS (A5) circuit breaker on CB1 and wait one minute.

(ag) Cycle YAW SAS 1 switchlight OFF then on again.

(ah) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (ai).

No: Original yaw rate gyro No. 1 was faulty.

(ai) Rudder servo No. 1 is suspected of being faulty. Perform rudder control system adjustment and test (Ref. 27-21-00) for rudder system No. 1.

(aj) From Step (ai). Does rudder control System perform per adjustment and test procedure?

Yes: Go to Step (ak).

No: Perform rudder control system fault isolation procedure (Ref. 27-21-00).

(ak) From Step (aj). Replace rudder servo electrohydraulic servo valve (EHV) (Hyd Sys B) No. 1 (Ref. 27-21-09).

(al) Cycle YAW SAS 1 switchlight to OFF then on again.

(am) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (an).

No: Original EHV was faulty.

(an) From Step (am). Replace SAS shutoff valve No. 1 (SAS SOV Hyd Sys B) (Ref. 27-21-08) and rudder autopilot servo pressure switch No. 1 (Hyd Sys B) (Ref. 27-21-24).

(ao) Cycle YAW SAS 1 switchlight to OFF then on again.

(ap) Does YAW SAS 1 switchlight indicate FAIL?

R Yes: Replace the rudder servo module (Ref.
R 27-21-07). The modulating piston/coupler and/or
R feedback transducer (LVDT) is suspected of being
R faulty.

No: Original SAS shutoff valve or pressure switch was faulty.

---

(4) Fault: YAW SAS 2 FAIL at turn on.

(a) On flight control panel, is RUDDER LIMITER HYDRAULIC PUSH legend ON?

Yes: Go to Step (b).

No: Go to Step (i).

(b) From Step (a). RUDDER LIMITER HYDRAULIC PUSH legend ON. On CB2, open MLG GND SENSE (L8) circuit breaker.

(c) Shut off hydraulic system A. When hydraulic system A pressure drops to zero, perform Step (d).

(d) On CB2, close MLG GND SENSE (L8) circuit breaker.

(e) Turn on hydraulic system A.

(f) When 3,000 psi is available on hydraulic system A, perform Step (g).

(g) Cycle YAW SAS 2 switchlight to OFF for 1 minute, then on.

(h) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (i).

No: Rudder fusing is suspected of being faulty (Ref. 29-11-00).

(i) From Step (a) or (h). RUDDER LIMITER HYDRAULIC PUSH legend OFF. Open the following circuit breakers:

PILOTS OVHD CB PNL CB1

YAW SAS (A5)

YAW SAS (A23)

FE/SO OVHD CB PNL CB2

R AOA (F1)

(j) Replace yaw computer No. 2 (Ref. 22-15-01).

(k) Close circuit breakers opened in Step (i).

(l) Set both YAW SAS switchlights to OFF.

(m) Wait one minute, and set both YAW SAS switchlights to on.

(n) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (o).

No: Original yaw computer No. 2 was faulty.

R (o) From Step (n). Open YAW SAS (A23) circuit breaker on CB1. Measure the resistance to ground on the
R following yaw computer No. 2 shelf connector pins (should be greater than 40 ohms):

J2A-6

J2A-55

J2B-6

J4A-47

J4A-57

J4B-46

J4B-57

R (p) Did all of the above readings show greater than 40 ohms?

Yes: Go to Step (af).

No: Go to Step (q) for all pins except J2A-55. For a ground on J2A-55, go to Step (ac).

(q) Reinstall yaw computer No. 2. Close YAW SAS (A23) circuit breaker on CB1 and wait one minute. Open PITCH AND ROLL (A24) circuit breaker on CB1. On FESC avionic rack 3, remove pitch computer No. 2 (Ref. 22-11-01) and roll computer No. 2 (Ref. 22-13-01).

(r) Cycle YAW SAS 2 switchlight to OFF then on again.

(s) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Reinstall pitch and roll computers removed in Step (q) and then go Step (w).

No: Go to Step (t).

(t) Reinstall pitch computer No. 2 in FESC avionic rack 3.

(u) Cycle YAW SAS 2 switchlight to OFF then on again.

(v) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Replace pitch computer No. 2 (Ref. 22-11-01).

No: Replace roll computer No. 2 (Ref. 22-13-01).

(w) From Step (s). In Hydraulic service center, disconnect flap power drive unit (PDU) connectors 2751-P5 and 2751-P6 from both flap PDU switchboxes.

(x) Cycle YAW SAS 2 switchlight to OFF then on again.

(y) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Reconnect both flap PDU connectors disconnected in Step (w) and go to Step (ai).

No: Go to Step (z).

(z) From Step (y). In hydraulic service center, reconnect flap PDU connector 2751-P6 to flap PDU switchbox No. 2.

(aa) Cycle YAW SAS 2 switchlight to OFF then on again.

(ab) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Replace flap PDU switchbox No. 2 (Ref. 27-51-12).

No: Replace flap PDU switchbox No. 1 (Ref. 27-51-12).

(ac) From Step (p). On pilots overhead panel, remove FCES control panel (Ref. 22-10-07).

(ad) Again measure impedance from yaw computer No. 2 pin J2A-55 (shelf connector) to ground (should be
R greater than 40 ohms).

R (ae) Did the above reading show greater than 40 ohms?

Yes: Replace FCES control panel (Ref. 22-10-07), then replace yaw computer No. 2 (Ref. 22-15-01).

No: Replace APFDS ENGAGE panel (Ref. 22-10-01), then replace yaw computer No. 2 (Ref. 22-15-01).

(af) From Step (p). On pilots overhead panel, replace FCES control panel (Ref. 22-10-07).

(ag) Cycle YAW SAS 2 switchlight to OFF then on again.

(ah) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (ai).

No: Original FCES panel was faulty.

(ai) From Step (y) or (ah). Open YAW SAS (A23) circuit breaker, if not already done. Remove yaw computer No. 2 from FESC avionic rack 3, if not already done. Measure continuity between yaw computer No. 2 shelf connector pins J2A-6 and J4A-26 (should be
R less than 40 ohms). Also ensure that there is no continuity between these points and ground.

(aj) Is there an open or ground between pins J2A-6 and J4A-26?

Yes: Go to Step (ak).

No: Go to Step (am).

(ak) From Step (aj). On left wing, open access door 551AB. Remove connector from aileron dual position transducer No. 2 and measure for continuity between transducer pins 4 and 5. Also ensure that there is no continuity between these points and ground.

(al) Is there an open or ground between aileron dual position transducer No. 2, pins 4 and 5?

Yes: Replace aileron dual position transducer No. 2 (Ref. 22-13-03). If a ground was present, replace yaw computer No. 2 (Ref. 22-15-01) in addition to aileron dual position transducer No. 2.

No: Reconnect connector to aileron dual position transducer No. 2 and close access door 551AB. On rudder, open access door 324CL and remove access panel 325DL. Replace rudder dual position transducer No. 2 (Ref. 22-15-03). If a ground was present, replace yaw computer No. 2 (Ref. 22-15-01) in addition to rudder dual position transducer No. 2.

(am) From Step (aj). Open YAW SAS (A23) circuit breaker on CB1, if not already done. Replace yaw rate gyro No. 2 (Ref. 22-15-02).

(an) Close YAW SAS (A23) circuit breaker on CB1 and wait one minute.

(ao) Cycle YAW SAS 2 switchlight OFF then on again.

(ap) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (aq).

No: Original yaw rate gyro No. 2 was faulty.

(aq) From Step (ap). Rudder servo No. 2 is suspected of being faulty. Perform rudder control system adjustment and test (Ref. 27-21-00) for rudder system No. 2.

(ar) Does rudder control system perform per adjustment and test procedure?

Yes: Go to Step (as).

No: Perform rudder control system fault isolation procedure (Ref. 27-21-00).

(as) From Step (ar). Replace rudder servo electrohydraulic servo valve (EHV) (HYD SYS A) No. 2 (Ref. 27-21-09).

(at) Cycle YAW SAS 2 switchlight to OFF then on again.

(au) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (av).

No: Original EHV was faulty.

(av) From Step (au). Replace SAS shutoff valve (SAS SOV Hyd Sys A) No. 2 (Ref. 27-21-08) and rudder autopilot servo pressure switch No. 2 (Hyd Sys A) (Ref. 27-21-24).

(aw) Cycle YAW SAS 2 switchlight to OFF then on again.

(ax) Does YAW SAS 2 switchlight indicate FAIL?

R Yes: Replace rudder servo module (Ref. 27-21-07).
R The modulating piston/coupler and/or feedback
R transducer (LVDT) is suspected of being faulty.

No: Original SAS shutoff valve or pressure switch was faulty.

---

(5) Fault: Rudder does not remain centered at turn on.

(a) Check left wing aileron dual position transducer No. 1 rigging and electrical null by performing installation procedure (Ref. 22-13-03).

(b) Is dual aileron position transducer No. 1 within tolerances?

Yes: Replace the rudder servo module (Ref. 27-21-07). The modulating piston/coupler and/or feedback transducer is suspected of being faulty.

No: Correct rigging or null (Ref. 22-13-03).

---

(6) Fault: YAW SAS 1 and/or 2 FAIL when rotating control wheel, flaps at 0 deg., dual channel.

(a) This means a combination of multiple faults has occurred. Perform turn coordination single channel - 0-degree flap test procedure D to isolate.

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(7) Fault: YAW SAS 1 and/or 2 FAIL when pushing rudder pedal, flaps at 0 deg., dual channel.

(a) On pilots overhead circuit breaker panel CB1, open YAW SAS (A23) circuit breaker. Cycle YAW SAS 1 switchlight to OFF then on. YAW SAS 1 switchlight shall be dark.

(b) Repeat test procedure D(3).

(c) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Replace rudder autopilot servo pressure switch No. 1 (HYD SYS B, AVIONIC SYS No. 1) (Ref. 27-21-24).

No: Replace rudder autopilot servo pressure switch No. 2 (HYD SYS A, AVIONIC SYS No. 2) (Ref. 27-21-24).

---

(8) Fault: Rudder does not remain centered, flaps at 0 deg., only YAW SAS 1 on.

(a) Check left wiring aileron dual position transducer No. 1 rigging and electrical null by performing installation procedure (Ref. 22-13-03).

(b) Is dual aileron position transducer No. 1 within tolerances?

Yes: Replace the rudder servo module, (Ref. 27-21-07). The modulating piston/coupler and/or feedback transducer is suspected of being faulty.

No: Correct rigging or null (Ref. 22-13-03).

---

(9) Fault: YAW SAS 1 FAIL and/or rudder does not respond (move) properly when rotating control wheel, flaps at 0 deg., only YAW SAS 1 on.

(a) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (b).

No: Go to Step (c).

(b) From Step (a). Does rudder start to respond then snap back to zero?

Yes: Go to Step (d).

No: Go to Step (f).

(c) From Step (a). Does rudder respond (move) properly?

Yes: Go to Step (f).

No: Go to Step (e).

(d) Replace yaw computer No. 1 (Ref. 22-15-01). Repeat test procedures D(1) through D(3). Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (f).

No: Original yaw computer No. 1 was faulty.

(e) From Step (c). Replace yaw computer No. 1 (Ref. 22-15-01). Repeat test procedures D(1) through D(3). Does rudder respond (move) properly?

Yes: Original yaw computer No. 1 was faulty.

No: Go to Step (f).

(f) From Step (c), or (d), or (e). Open YAW SAS (A5) circuit breaker on CB1. Remove yaw computer No. 1 (Ref. 22-15-01).

(g) Measure the resistance to ground on the following yaw computer No. 1 shelf connector pins (should be greater than 40 ohms):

J1A-2 to ground

J1B-2 to ground

(h) Did both of the above readings show greater than 40 ohms?

Yes: Go to Step (r).

No: If J1A-2 was bad, go to Step (i). If J1B-2 was bad, go to Step (l).

(i) From Step (h). Open gyro access door in galley ceiling (zone 135) and disconnect connector 2215-P5 from yaw rate gyro No. 1.

(j) Measure the resistance to ground on yaw computer No. 1 shelf connector J1A-2 pin (should be greater than 40 ohms).

(k) Did the above reading show greater than 40 ohms?

Yes: Replace yaw rate gyro No. 1 (Ref. 22-15-02) and then replace yaw computer No. 1 (Ref. 22-15-01).

No: Reconnect yaw rate gyro No. 1 connector 2215-P5 and close gyro access door. Go to Step (l).

(l) From Step (h) or (k). On left wing, open access door 551AB. Remove connector (2713-P5) from aileron dual position transducer No. 1.

(m) Measure resistance to ground on the following yaw computer No. 1 shelf connector pins (should be greater than 40 ohms):

J1A-2

J1B-2

R (n) Did the above reading show greater than 40 ohms?

Yes: Replace aileron dual position transducer No. 1 (Ref. 22-13-03), then replace Yaw Computer No. 1 (Ref. 22-15-01).

No: Reconnect aileron dual position transducer connector and close access door 551AB. Go to Step (o).

(o) From Step (n). On rudder, open access door 324C and remove access panel 325DL. Disconnect rudder dual position transducer No. 1 connector (2723-P5).

R (p) Measure resistance to ground on the following yaw computer No. 1 shelf connector pins (should be
R greater than 40 ohms):

J1A-2

J1B-2

R (q) Did the above readings show greater than 40 ohms?

Yes: Replace rudder dual position transducer No. 1 (Ref. 22-15-03) then replace yaw computer No. 1 (Ref. 22-15-01).

No: Reconnect rudder dual position transducer connector (2723-P5). Install access panel 325DL and close access door 324CL. Go to Step (u).

(r) From Step (h). On left wing, open access door 551AB. Replace aileron dual position transducer No. 1 (Ref. 22-13-03).

(s) Reinstall yaw computer No. 1 and close YAW SAS (A5) circuit breaker on CB1. Repeat test procedure D(1) through D(3).

(t) Does YAW SAS No. 1 perform properly?

Yes: Original aileron dual position tranducer No. 1 was faulty.

No: Go to Step (u).

(u) From Step (q) or (t). Replace solenoid valve No. 1 on rudder servo (SAS Hyd Sys B) (Ref. 27-21-08).

(v) Cycle YAW SAS No. 1 switchlight to OFF then on again.

(w) Repeat Paragraph D(1) thru D(3).

(x) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (y).

No: Original solenoid valve was faulty.

(y) From Step (x). The rudder servo No. 1 is suspected of being faulty. Perform rudder control system adjustment and test (Ref. 27-21-00).

(z) Does rudder system perform per checkout procedure?

Yes: Replace rudder servo module (Ref. 27-21-07). The modulating position/coupler and/or feedback transducer is suspected of being faulty.

No: Perform rudder control system fault isolation (Ref. 27-21-00).

---

(10) Fault: Rudder does not remain centered, flaps 0 deg., only YAW SAS 2 on.

(a) Check left wing aileron dual position transducer No. 2 rigging and electrical null by performing installation procedure (Ref. 22-13-03).

(b) Is dual aileron position transducer No. 1 within tolerances?

Yes: Replace the rudder servo module (Ref. 27-21-07). The modulating piston/coupler and/or feedback transducer is suspected of being faulty.

No: Correct rigging or null (Ref. 22-13-03).

---

(11) Fault: YAW SAS 2 FAIL and/or rudder does not respond (move) properly when rotating control wheel, flaps at 0 deg., only YAW SAS 2 on.

(a) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (b).

No: Go to Step (c).

(b) Does rudder start to respond then snap back to zero?

Yes: Go to Step (d).

No: Go to Step (f).

(c) Does rudder respond (move) properly?

Yes: Go to Step (f).

No: Go to Step (e).

(d) Replace yaw computer No. 2 (Ref. 22-15-01). Repeat test procedures D(4) through D(7). Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (f).

R No: Original yaw computer No. 2 was faulty.

(e) Replace yaw computer No. 2 (Ref. 22-15-01). Repeat test procedures D(4) through D(7). Does rudder respond (move) properly?

Yes: Original yaw computer No. 2 was faulty.

No: Go to Step (f).

(f) Open YAW SAS (A23) circuit breaker on CB1. Remove yaw computer No. 2 (Ref. 22-15-01).

R (g) Measure the resistance to ground on the following
R yaw computer No. 2 shelf connector pins (should be greater than 40 ohms):

J2A-2

J2B-2

R (h) Did both of the above readings show greater than
R 40 ohms?

Yes: Go to Step (r).

No: If J2A-2 was bad, go to Step (i). If J2B-2 was bad, go to Step (l).

(i) Open gyro access door in galley ceiling (zone 135) and disconnect connector 2215-P6 from yaw rate gyro No. 2.

R R (j) Measure resistance to ground on yaw computer shelf connector pins J2A-2 to ground (should be greater than 40 ohms).

R (k) Did the above reading show greater than 40 ohms?

Yes: Replace yaw rate gyro No. 2 (Ref. 22-15-02) and then replace yaw computer No. 2 (Ref. 22-15-01).

No: Reconnect yaw rate gyro No. 2 connector 2215-P6 and close gyro access door. Go to Step (l).

(l) On left wing, open access door 551AB. Remove connector (2713-P6) from aileron dual position transducer No. 2.

R R (m) Measure resistance to ground on the following yaw computer No. 2 shelf connector pins (should be greater than 40 ohms):

J2A-2

J2B-2

R (n) Did the above reading show greater than 40 ohms?

Yes: Replace aileron dual position transducer No. 2 (Ref. 22-13-03) then replace yaw computer No. 2 (Ref. 22-15-01).

No: Reconnect aileron dual position transducer connector and close access door 551AB.

(o) On rudder, open access door 324CL and remove access panel 325DL. Disconnect rudder dual position transducer No. 2 connector (2723-P6).

R R (p) Measure resistance to ground on the following yaw computer No. 2 shelf connector pins (should be greater than 40 ohms):

J2A-2

J2B-2

R (q) Did the above readings show greater than 40 ohms?

Yes: Replace rudder dual position transducer No. 2 (Ref. 22-15-03) then replace yaw computer No. 2 (Ref. 22-15-01).

No: Reconnect rudder dual position transducer connector (2723-P6). Install access panel 325DL and close access door 324CL. Go to Step (u).

(r) On left wing, open access door 551AB. Replace aileron dual position transducer No. 2 (Ref. 22-13-03).

(s) Reinstall yaw computer No. 2 (Ref. 22-15-01) and close YAW SAS (A23) circuit breaker on CB1. Repeat test procedures D(4) through D(7).

(t) Does YAW SAS No. 2 perform properly?

Yes: Original aileron dual position transducer No. 2 was faulty.

No: Go to Step (u).

(u) Replace solenoid valve No. 2 on rudder servo (SAS Hyd Sys A) (Ref. 22-21-08).

(v) Cycle YAW SAS No. 2 switchlight to OFF then on again.

(w) Repeat Paragraph D(4) thru (7).

(x) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (y).

No: Original solenoid valve was faulty.

(y) The rudder servo No. 2 is suspected of being faulty. Perform rudder control system adjustment and test (Ref. 27-21-00).

(z) Does rudder system perform per checkout procedure?

Yes: Replace rudder servo module (Ref. 27-21-07). The modulating piston/coupler and/or feedback transducer is suspected of being faulty.

No: Perform rudder control system fault isolation (Ref. 27-21-00).

(12) Fault: YAW SAS 1 and 2 FAIL when rotating control wheel, flaps at 4 deg., dual channel.

(a) Flap PDU Switchbox is suspected of being faulty. Perform turn coordination single channel - flap 4-degree test procedure F to isolate.

(13) Fault: YAW SAS 1 FAIL when rotating control wheel, flaps at 4 deg., only YAW SAS 1 on.

(a) Replace yaw computer No. 1 (Ref. 22-15-01).

(b) Repeat test procedures F(1) through F(3).

(c) Does YAW SAS 1 Switchlight indicate FAIL?

Yes: Go to Step (d).

No: Original yaw computer No. 1 was faulty.

(d) On CB1, open AUTO THROT SERVO (A1), SPEED CONT (A2), and SPEED CONT (A20) circuit breakers.

(e) Remove speed control computer (Ref. 22-31-07).

(f) Repeat test procedures F(1) through F(3).

(g) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Reinstall speed control computer, (Ref. 22-31-07) and circuit breakers opened in Step (d). Go to Step (h).

No: Replace speed control computer (Ref. 22-31-07).

(h) Replace Flap PDU Switchbox No. 1, it is suspected of being faulty (Ref. 27-51-12).

(i) Repeat test procedures F(1) through F(3).

(j) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Reinstall original Flap PDU Switchbox No. 1. Replace Flap PDU Switchbox No. 2 (Ref. 27-51-12).

No: Original Flap PDU Switchbox was faulty.

(14) Fault: YAW SAS 2 FAIL when rotating control wheel, flaps at 4 deg., only YAW SAS 2 on.

(a) Replace yaw computer No. 2 (Ref. 22-15-01).

(b) Repeat test procedures F(1) through F(8).

(c) Does YAW SAS 2 Switchlight indicate FAIL?

Yes: Go to Step (d).

No: Original yaw computer No. 2 was faulty.

(d) On CB1, open AUTO THROT SERVO (A1), SPEED CONT (A2), and SPEED CONT (A20) circuit breakers.

(e) Remove speed control computer (Ref. 22-31-07).

(f) Repeat test procedures F(4) through F(8).

(g) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Reinstall speed control computer (Ref. 22-31-07) and close circuit breakers opened in Step (d).

Go to Step (h) No: Replace speed control computer (Ref. 22-31-07).

(h) Replace Flap PDU Switchbox No. 2 (Ref. 27-51-12).

(i) Repeat test procedures F(4) through F(8).

(j) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Reinstall Flap PDU Switchbox No. 2. Replace Flap PDU Switchbox No. 1 (Ref. 27-51-12).

No: Original Flap PDU Switchbox was faulty.

(15) Fault: YAW SAS 1 and 2 FAIL when rotating control wheel, flaps at 33 deg., dual channel.

(a) Flap PDU Switchbox is suspected of being faulty. Perform turn coordination single channel - flap 33-degree test procedure H to isolate.

(16) Fault: YAW SAS 1 FAIL when rotating control wheel, flaps at 33 deg., only YAW SAS 1 on.

(a) Replace yaw computer No. 1 (Ref. 22-15-01).

(b) Repeat test procedures H(1) through H(3).

(c) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Go to Step (d).

No: Original yaw computer No. 1 was faulty.

(d) On CB1, open PITCH & ROLL (A6) circuit breaker.

(e) Remove pitch computer No. 1 (Ref. 22-11-01).

(f) Repeat test procedures H(1) through H(3).

(g) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Reinstall pitch computer No. 1 (Ref. 22-11-01) and close circuit breaker opened in Step (d). Go to Step (h).

No: Replace pitch computer No. 1 (Ref. 22-11-01).

(h) Replace Flap PDU Switchbox No. 1 (Ref. 27-51-12).

(i) Repeat test procedures H(1) through H(3).

(j) Does YAW SAS 1 switchlight indicate FAIL?

Yes: Reinstall Flap PDU Switchbox No. 1. Replace Flap PDU Switchbox No. 2 (Ref. 27-51-12).

No: Original Flap PDU Switchbox was faulty.

(17) Fault: YAW SAS 2 FAIL when rotating control wheel, flaps at 33 deg., only YAW SAS 2 on.

(a) Replace yaw computer No. 2 (Ref. 22-15-01).

(b) Repeat test procedures H(4) through H(8).

(c) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Go to Step (d).

No: Original yaw computer No. 2 was faulty.

(d) On CB1, open PITCH & ROLL (A24) circuit breaker.

(e) Remove pitch computer No. 2 (Ref. 22-11-01).

(f) Repeat test procedures H(4) through H(8).

(g) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Reinstall pitch computer No. 2 (Ref. 22-11-01) and close circuit breaker opened in Step (d). Go to Step (h).

No: Replace pitch computer No. 2 (Ref. 22-11-01).

(h) Replace Flap PDU Switchbox No. 2, it is suspected of being faulty (Ref. 27-51-12).

(i) Repeat test procedures H(4) through H(8).

(j) Does YAW SAS 2 Switchlight indicate FAIL?

Yes: Reinstall Flap PDU Switchbox No. 2. Replace Flap PDU Switchbox No. 1. (Ref. 27-51-12).

No: Original Flap PDU Switchbox was faulty.

---

(18) Fault: YAW SAS 1 and/or 2 FAIL during turn coordination crossfeeds test.

(a) Did both YAW SAS FAIL?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01) and go to Step (b).

No: Only one YAW SAS switchlight indicates FAIL. Go to Step (e).

(b) Repeat test procedure I.

(c) Do both YAW SAS switchlights indicate FAIL?

Yes: Go to Step (d).

No: Original yaw computer No. 1 was faulty.

(d) Replace yaw computer No. 2 (Ref. 22-15-01).

(e) Replace yaw computer associated with FAIL light; i.e., YAW SAS switchlight 1 and yaw computer No. 1, etc., and go to Step (f).

(f) Repeat test procedure 1.

(g) Does the same YAW SAS switchlight indicate FAIL?

Yes: Replace the other yaw computer, i.e., the yaw computer not replaced in Step (e).

No: Original yaw computer was faulty.

---

(19) Fault: YAW SAS 1 does not FAIL when rotating rate gyro No. 1 during rate gyro test.

(a) Replace yaw rate gyro No. 1 (Ref. 22-15-02).

---

(20) Fault: YAW SAS 1 does not FAIL when rotating rate gyro No. 3 during rate gyro test.

(a) Perform test procedures J(7) through J(9).

(b) Does YAW SAS 2 switchlight indicate FAIL?

Yes: Replace yaw computer No. 1 (Ref. 22-15-01).

No: Replace yaw rate gyro No. 3 (Ref. 22-15-02).

---

(21) Fault: Yaw SAS 2 does not FAIL when rotating rate gyro No. 3 during rate gyro test.

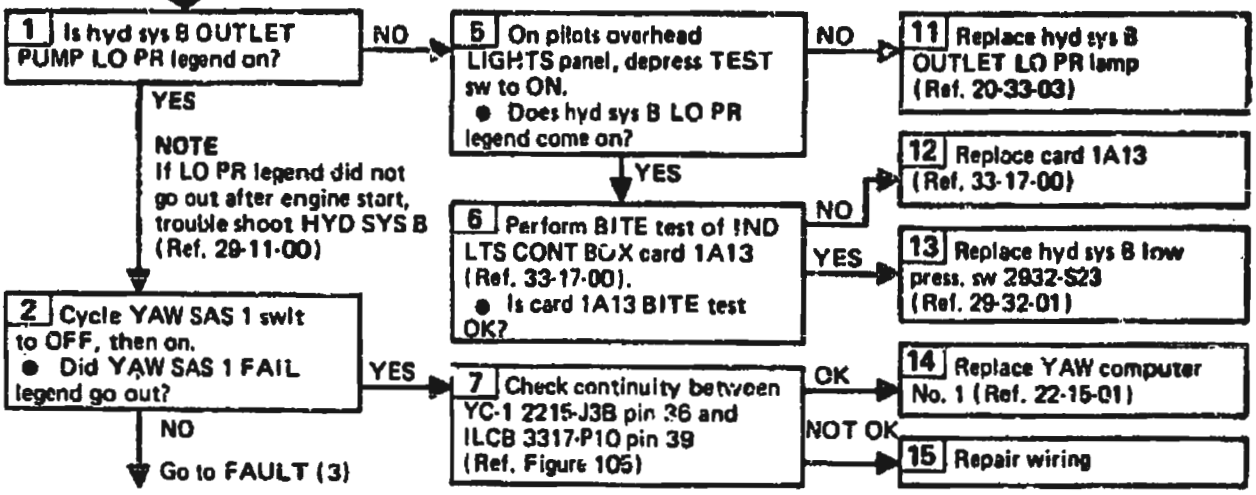
(a) Replace yaw computer No. 2 (Ref. 22-15-01).

---

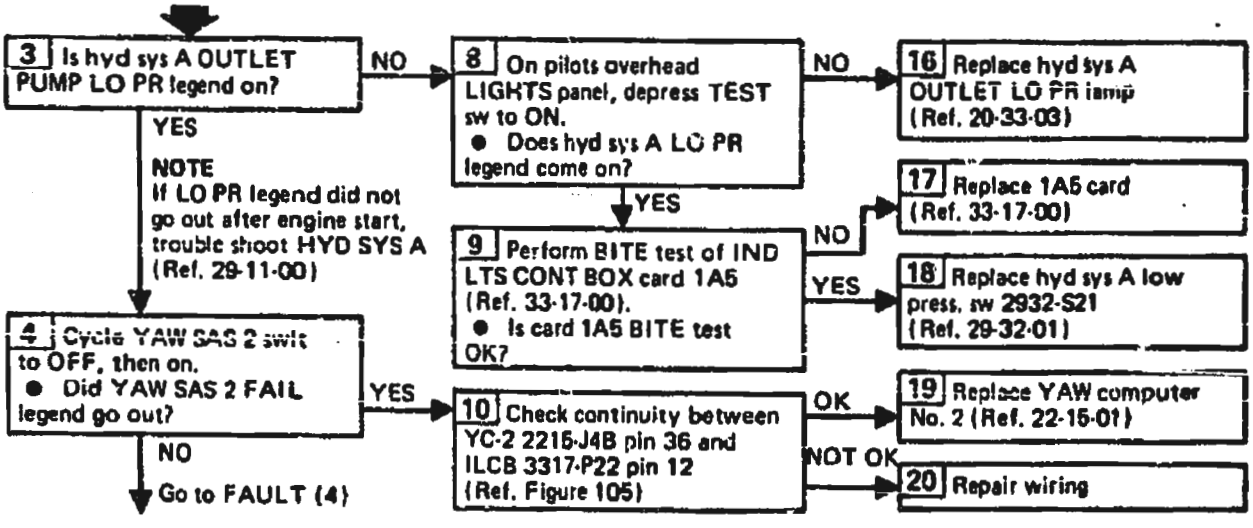
(22) Fault Yaw SAS 2 does not FAIL when rotating rate gyro No. 2 during test.

(a) Replace yaw rate gyro No. 2 (Ref. 22-15-02).

YAW SAS 1 FAIL LEGEND DID NOT AUTOMATICALLY RESET AFTER ENGINE NO. 2 START


1 Is hyd sys B OUTLET PUMP LO PR legend on?
NO
5 On pilots overhead LIGHTS panel, depress TEST sw to ON.
● Does hyd sys B LO PR legend come on?
NO
11 Replace hyd sys B OUTLET LO PR lamp (Ref. 20-33-03)
YES
12 Replace card 1A13 (Ref. 33-17-00)
NO
6 Perform BITE test of IND LTS CONT BOX card 1A13 (Ref. 33-17-00).
● Is card 1A13 BITE test OK?
YES
13 Replace hyd sys B low press. sw 2932-S23 (Ref. 29-32-01)
YES
NOTE
If LO PR legend did not go out after engine start, trouble shoot HYD SYS B (Ref. 29-11-00)
2 Cycle YAW SAS 1 swit to OFF, then on.
● Did YAW SAS 1 FAIL legend go out?
YES
7 Check continuity between YC-1 2215-J3B pin 36 and ILCB 3317-P10 pin 39 (Ref. Figure 105)
OK
14 Replace YAW computer No. 1 (Ref. 22-15-01)
NOT OK
15 Repair wiring
NO
Go to FAULT (3)

YAW SAS 2 FAIL LEGEND DID NOT AUTOMATICALLY RESET AFTER ENGINE NO. 1 START


3 Is hyd sys A OUTLET PUMP LO PR legend on?
NO
8 On pilots overhead LIGHTS panel, depress TEST sw to ON.
● Does hyd sys A LO PR legend come on?
NO
16 Replace hyd sys A OUTLET LO PR lamp (Ref. 20-33-03)
YES
17 Replace 1A5 card (Ref. 33-17-00)
NO
9 Perform BITE test of IND LTS CONT BOX card 1A5 (Ref. 33-17-00).
● Is card 1A5 BITE test OK?
YES
18 Replace hyd sys A low press. sw 2932-S21 (Ref. 29-32-01)
YES
NOTE
If LO PR legend did not go out after engine start, trouble shoot HYD SYS A (Ref. 29-11-00)
4 Cycle YAW SAS 2 swit to OFF, then on.
● Did YAW SAS 2 FAIL legend go out?
YES
10 Check continuity between YC-2 2215-J4B pin 36 and ILCB 3317-P22 pin 12 (Ref. Figure 105)
OK
19 Replace YAW computer No. 2 (Ref. 22-15-01)
NOT OK
20 Repair wiring
NO
Go to FAULT (4)

PREREQUISITES

YAW SAS 1 and 2 to on.
HYD A and B SUCT S/O sw to on.
HYD A and B PUMP S/O sw to on.
HYD A and B to on.
CB's: 1A5, 1A23, 1B5, 1D27, 1J23, 1L9
2H1, 2H2, 2H3, 2H4, 2H5, 2H8, 2H9, 2H10
2K12, 2K13, 2K14, 2K18, 2K19, 2L16
3G8, 3G9

NOTE

Starting engine No. 2 automatically resets YAW SAS 1 FAIL legend (engine HYD B pump low press. sw)

Starting engine No. 1 automatically resets YAW SAS 2 FAIL legend (engine HYD A pump low press. sw)

Turning on HYD power by any other means will not automatically reset YAW SAS. To reset YAW SAS manually, set both YAW SAS switchlights to OFF for approx. 1 min., then on

EM1-0100-22-460

Yaw SAS FAIL Legend Will Not Automatically Reset After Engine Start
Table 503

R
R
001B

EFFECTIVITY: ALL

YAW SAS COMPUTER - MAINTENANCE PRACTICES

1. General

When No. 1 or No. 2 YAW SAS computer is inoperative, Dual AUTOLAND will not be available. The following procedure specifies the method used to deactivate a YAW SAS computer if the aircraft is to be dispatched with one unit inoperative.

2. Maintenance Practices

A. Deactivation

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

(1) On FCES control panel, depress YAW SAS-1 (or YAW SAS-2) switchlight to indicate OFF, as appropriate.

(2) Placard flight station AP-A (or AP-B) and YAW SAS-1 (or YAW SAS-2) INOPERABLE DUAL AUTOLAND NOT AVAILABLE.

(3) Make appropriate entry in aircraft log book.

YAW COMPUTER - REMOVAL AND INSTALLATION

1. Referenced Procedures

29-11-00 Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following applicable circuit breaker:

(a) For yaw computer No. 1: AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS (A5)

(b) For yaw computer No. 2: AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS (A23)

(2) In forward electronic service center, zone 112, locate yaw computer in center rack (Ref. Fig. 401).

(3) Release holddowns on computer front panel.

(4) Pull computer handle to release computer electrical connectors from mount connectors and slide computer out of mounting rack.

B. Installation

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

R
R NOTE: On aircraft 019-999, (heavyweight aircraft), 672293-115 or -119 yaw computers shall be installed. When a 672293-113 or -117 yaw computer is installed in a heavyweight aircraft, the corresponding YAW SAS system will FAIL. However, the heavyweight aircraft computers are compatible with the lightweight aircraft and may be installed in them.

(2) Slide yaw computer (Ref. Fig. 401) into mount until computer electrical connectors mate with mount connectors.

(3) Secure computer with holddowns.

(4) Remove tag and close circuit breaker opened in Step A(1).

(5) Perform operational test in Step C.

C. Operational Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

R

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic systems A, B, C and D (Reference 29-11-00).

(2) Set flaps to greater than 30 degrees.

(3) On FCES panel, depress YAW SAS 1 and 2 switchlight to OFF, then on.

RESULT:

OFF lights come on in off position, and switchlights are dark in on position.

(4) Depress YAW SAS 2 switchlight to OFF.

(5) Rotate either control wheel CW, CCW and then center.

RESULT:

On surface position indicator (SPI), RUD needle moves right, left, and then center.

Rudder pedals do not move.

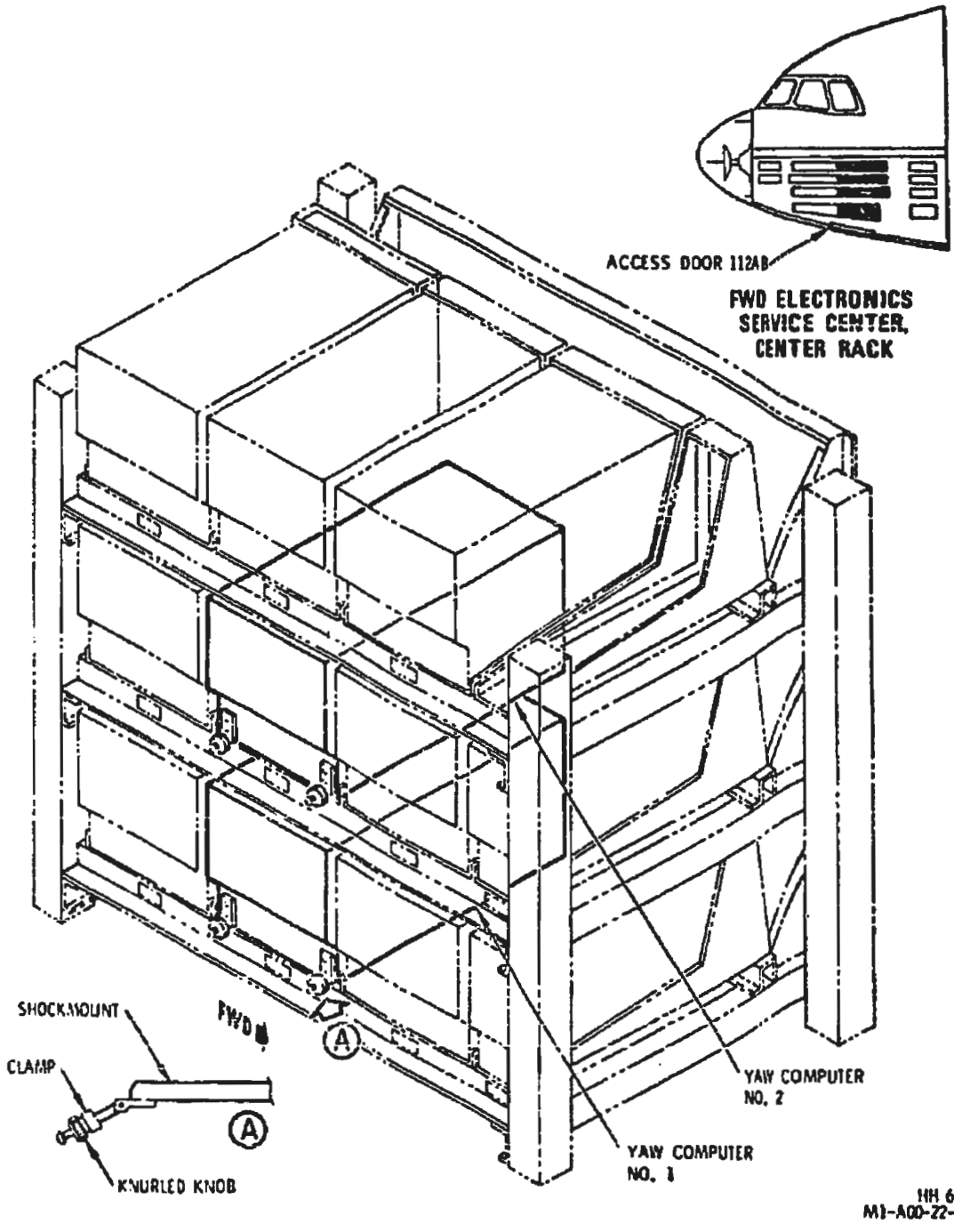
(6) Depress YAW SAS 1 switchlight to OFF, and YAW SAS 2 switchlight to ON.

(7) Repeat Step (5).

(8) Depress YAW SAS 1 switchlight to on.

(9) Retract flaps to zero degrees.

(10) Turn off hydraulic system.



R
R Yaw Computer - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

YAW RATE GYRO - REMOVAL AND INSTALLATION

1. Referenced Procedures

29-11-00 Hydraulic Power System - Maintenance Practices

2. Removal/Installation

A. Removal

CAUTION: Before removing gyro, allow 3 minutes after opening circuit breaker for gyro spin down.

(1) To remove yaw rate gyro No. 1, open and tag the following circuit breaker:

On pilots overhead circuit breaker panel CB1, zone 210, AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS (A5).

To remove yaw rate gyro No. 2, open and tag the following circuit breaker:

On pilots overhead circuit breaker panel CB1, zone 210, AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS (A23)

To remove yaw rate gyro No. 3, open and tag the following circuit breakers:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, FLIGHT STATION MISC - R AOA (F1)

(2) Open gyro access door in galley ceiling, zone 135.

(3) Disconnect electrical connector from yaw rate gyro (Ref. Fig. 401).

R (4) Remove mounting screws, and remove gyro.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Position gyro and secure (Ref. Fig. 401).

NOTE: Yaw rate gyro installation requires different length screws. See IPC 22-15-02 Fig. 1.

R

(3) Connect electrical connector to gyro.

(4) Close access door.

(5) Remove tag and close circuit breaker opened in Step A(1).

(6) Perform operational test in Step C.

C. Operational Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic systems A and B (Reference 29-11-00).

(2) Set flaps to greater than 30 degrees.

NOTE: Wait until yaw rate gyros reach normal speed (at least one minute after power applied to gyros) before performing step (3).

(3) On FCES panel, depress YAW SAS 1 and 2 switchlight to OFF, then on.

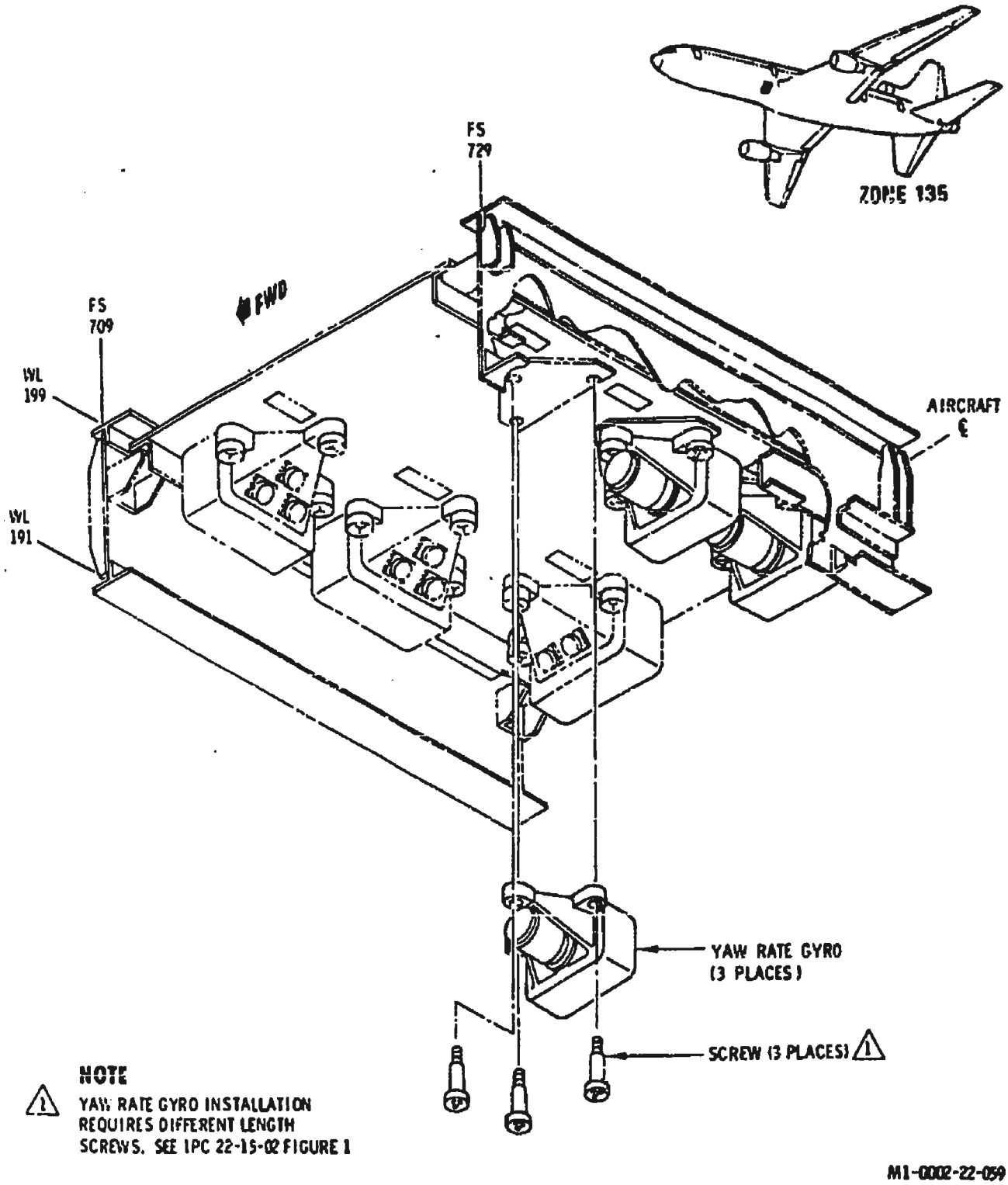
RESULT:

OFF lights come on in off position, and switchlights are dark in on position.

(4) On FCES computer, depress RESET switch and check that yaw rate gyro FIM are black.

(5) Retract flaps to zero degrees.

(6) Turn off hydraulic system.



R
R Yaw Rate Gyro - Removal and Installation
Figure 401

RUDDER DUAL POSITION TRANSDUCER - REMOVAL AND INSTALLATION

1. Equipment and Materials

Rudder holding devices (rudder faired)

C GEN 3109 Test Harness Dual Position Transducer, IT&E Manual
C 22-12-01

R Triplet Model 601 - ac voltmeter capable of reading 100 MV full scale or equivalent.

2. Referenced Procedures

22-15-03 Rudder Dual Position Transducer - Adjustment and Test

29-11-00 Hydraulic Power System - Maintenance Practices

3. Removal/Installation

NOTE: The following removal/installation procedure is applicable for the No. 1 and No. 2 transducers.

A. Removal

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag following applicable circuit breaker:

(a) For rudder position transducer No. 1:

AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - YAW SAS (A5)

(b) For rudder position transducer No. 2:

AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - YAW SAS (A23)

(2) Open access door 324CL and remove access panel 325DL.

(3) Disconnect electrical connector from transducer (Ref. Fig. 401).

(4) Remove nuts, washers, and screws securing cover halves (covering transducer mount), and remove cover halves.

(5) Remove nut and bolt securing transducer shaft to arm assembly.

R (6) Remove nut, washer, and bolt on transducer-holding clamp on transducer mount.

(7) Spread clamp and remove transducer.

B. Installation

WARNING: ENSURE THAT ALL FOUR HYDRAULIC SYSTEMS ARE SHUT OFF (REF. 29-11-00). TAG FLIGHT ENGINEER/SECOND OFFICERS HYDRAULIC SYSTEM PANEL, ZONE 215, AND THE HYDRAULIC SERVICE PANEL, ZONE 147.

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

(2) Secure rudder in faired position with a holding device.

R CAUTION: DO NOT FORCE ROTATION OF TRANSDUCER BEYOND
R INTERNAL STOPS (±120 DEGREES FROM EZ INDEX MARKS).

(3) Rotate transducer rotor shaft to align shaft electrical zero (EZ) index mark with EZ index mark on transducer housing (Ref. Fig. 401).

(4) Insert shaft end of transducer through clamp on
R transducer mount and serrated hole in mating arm
R assembly.

(5) Install but do not tighten bolt, washers, and nut to transducer-holding clamp on transducer mount (Ref. Fig. 401).

R (6) Install bolt and nut on arm assembly and tighten.

CAUTION: THE EZ INDICES MUST BE ALIGNED.

(7) Connect position transducer breakout box to transducer receptacle, and to transducer electrical connector.

(8) Connect ac voltmeter to position transducer breakout box as follows:

AC Voltmeter	Receptacle (J1)
Input (High)	Pin 2
Input (Low)	Pin 8

R R R NOTE: Second transducer null may be checked by connecting voltmeter to pin 11 (High) and pin 9 (Low).

(9) Remove tags and close circuit breakers opened in Step A(1).

(10) Adjust transducer housing until the ac voltmeter indicates a null less than 60 MV.

(11) Torque bolt, washers, and nut on clamp to 30-35 lb-in.

(12) Ensure that ac voltmeter indicates a null less than 60 MV.

(13) Open and tag circuit breakers listed in Step A(1).

(14) Disconnect position transducer breakout box connectors.

(15) Install cover halves over transducer mount and secure.

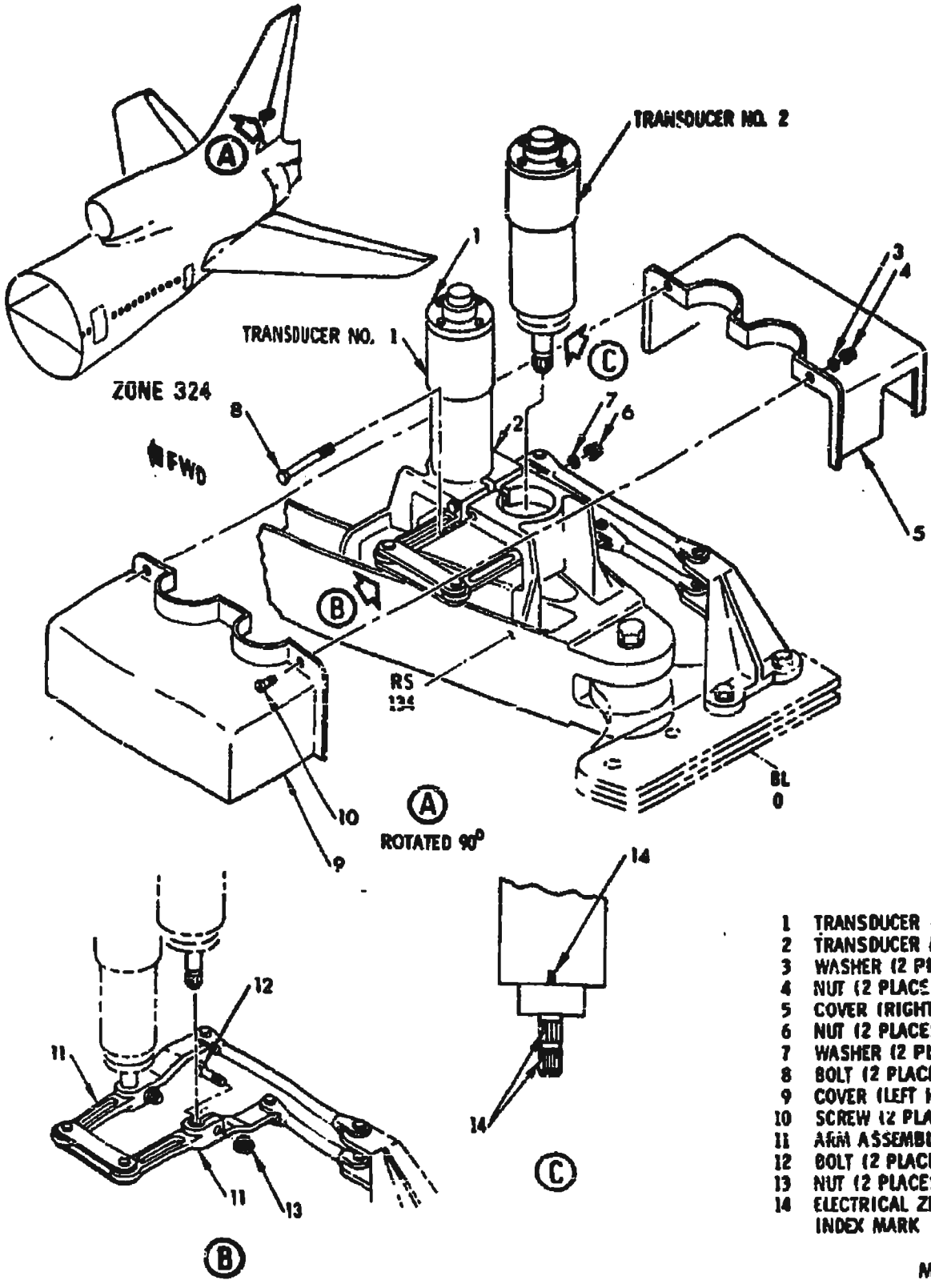
(16) Connect electrical connector to transducer.

(17) Install access panel 325DL and close access door 324CL.

(18) Remove support from rudder.

(19) Remove tag and close circuit breaker opened in Step A(1).

(20) Perform rudder dual position transducer adjustment and test (Ref. 22-15-03).



1 TRANSDUCER (2 PLACES)
2 TRANSDUCER MOUNT
3 WASHER (2 PLACES)
4 NUT (2 PLACES)
5 COVER (RIGHT HALF)
6 NUT (2 PLACES)
7 WASHER (2 PLACES)
8 BOLT (2 PLACES)
9 COVER (LEFT HALF)
10 SCREW (2 PLACES)
11 ARM ASSEMBLY
12 BOLT (2 PLACES)
13 NUT (2 PLACES)
14 ELECTRICAL ZERO (EZ) INDEX MARK

M1-0001-22-060

R Rudder Dual Position Transducer - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

RUDDER DUAL POSITION TRANSDUCER - ADJUSTMENT AND TEST

1. Equipment and Materials

VOR/ILS Ramp Test Set T-30, or equivalent

2. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-00	Ram Air Turbine - Maintenance Practices
32-63-00	Air/Ground Sensing System - Maintenance Practices
34-14-00	Central Air Data Computer System - Maintenance Practices
34-21-00	Attitude Reference System - Maintenance Practices
34-22-00	Magnetic Heading Reference System - Maintenance Practices
34-32-00	Radio Altimeter Systems - Maintenance Practices
34-33-00	Instrument Landing System - Maintenance Practices
R 34-43-00	Inertial Navigation System - Maintenance Practices

3. Adjustment/Test

A. Preparation

WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic systems A, B and C (Ref. 29-11-00).

(4) Verify that the following systems are on:

Central air data computer system (Ref. 34-14-00)

R R Attitude reference system (Ref. 34-21-00, 34-43-00)

Magretic heading reference system (Ref. 34-22-00)

Radio altimeter system (Ref. 34-32-00)

Instrument landing system (Ref. 34-33-00)

(5) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS

SPEED CONT (A2)

YAW SAS (A5)

PITCH & ROLL (A6)

TRIM AGMT AC (A7)

TRIM AGMT DC (A8)

AFCS MODE IND (B1)

FCES COMPUTERS DC (B4)

FCES COMPUTERS AC & L AOA (B5)

FCES STICK SHAKE (B6)

SPOILER DWELL DC (B7)

SPOILER DWELL AC (B8)

NO. 1 AFT COUPLER (B9)

NO. 2 SYSTEMS

SPEED CONT (A20)

YAW SAS (A23)

PITCH & ROLL (A24)

TRIM AGMT AC (A25)

TRIM AGMT DC (A26)

AFCS MODE IND (B19)

NO. 2 AFT COUPLER (B27)

ALT ALERT-2 (J21)

ALT ALERT-1 (K27)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

FLIGHT STATION MISC

R AOA (F1)

STICK SHAKE (F2)

AFCS WARNING

CAPT (K18)

F/O (K19)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed:

IND LT

PFCS ADS/DH (G8)

(6) On pilots overhead circuit breaker panel CB1, open and tag MISC - RAT AUTO DEPLOY (L3) circuit breaker.

R On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, open and tag NOSE STEERING (F19)
R circuit breaker.

(7) Install RAT ground safety lock (Ref. 29-21-00).

(8) Set all throttle levers to mid-position.

(9) Set flaps to 33 degrees.

(10) Simulate aircraft airborne condition (Ref. 32-63-00).

(11) Ensure that both HSI compass cards indicate same aircraft heading.

(12) On NAV MODE panel, set both COURSE knobs to aircraft heading.

(13) On VOR/ILS ramp test set T-30, turn on localizer and glideslope POWER switches (Ref. 34-33-00).

(14) On ramp test set, set LOC selector to RIGHT and GS selector to UP.

(15) On glareshields, set both VHF NAV panels to a frequency of 108.1 MHz.

(16) On PFCS MONITOR panel, ensure that RUDDER and L INBD AILERON switches are set to on, and that all STABILIZER switches are on.

B. Functional Test

(1) On FCES panel, depress YAW SAS 1 and 2 switchlights to on (dark).

(2) On APFDS ENGAGE panel, set both FD switches to ON. On both ADIs, command bars come into view.

(3) On APFDS engage panel, set AP A switch to CMD.

(4) On NAV MODE panel, depress A/L switchlight to turn on A/L light. The following messages appear on both AFCS MODES annunciators:

LOC ARM

GS ARM

A/L ARM

(5) On APFDS ENGAGE panel, set AP B switch to CMD.

(6) On ramp test set, set LOC selector to ON COURSE, and set GS selector to ON COURSE. On both AFCS MODES annunciators, LOC ARM and GS ARM messages change to LOC and GS.

(7) Approximately 25 seconds after GS capture (Step 6), the following indications occur:

(a) On both AFCS MODES annunciators, A/L ARM message changes to A/L, and ALIGN, FLARE and ROLLOUT messages appear.

(b) On both ADIs, command bars are biased out of view, and rollout bars are in view.

NOTE: During Steps (8) through (10), monitor rudder motion on the surface position indicator. Motion should be slow, uniform, and controllable in response to localizer deviation. Any abrupt change in position indicates a rudder position transducer fault.

(8) On ramp test set, set LOC selector to VARIABLE and slowly rotate LOC VARIABLE selector to indicate aircraft slightly right of course. Rollout bar and rudder move to left. (Rudder pedal follows rudder.)

(9) On ramp test set, slowly rotate LOC VARIABLE selector to indicate aircraft slightly left of course. Rollout bar and rudder move to right. (Rudder pedal follows rudder.)

(10) On ramp test set, slowly rotate LOC VARIABLE selector to indicate aircraft on course. Rollout bar and rudder center. (Rudder pedal follows rudder.)

(11) On FCES panel, depress YAW SAS 1 switchlight to OFF, and repeat Steps (8), (9), and (10).

(12) On APFDS ENGAGE panel, set both FD switches to OFF.

(13) On control wheel, depress A/P disconnect switch twice. On APFDS ENGAGE panel, AP A and B switches disengage to OFF.

C. Test Completion

(1) Disconnect test setup.

(2) Return aircraft to on-ground condition (Ref. 32-63-00).

R (3) On pilots overhead circuit breaker panel CB1, remove
R tag and close MISC - RAT AUTO DEPLOY (L3) circuit
R breaker.

R On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, remove tag and close NOSE STEERING
R (F19) circuit breaker.

(4) Remove RAT ground safety lock (Ref. 29-21-00).

(5) Turn off hydraulic power (Ref. 29-11-00).

(6) Turn off electrical power (Ref. 24-00-00).

FLIGHT CONTROL ELECTRONICS SYSTEM (FCES) - DESCRIPTION AND OPERATION

1. General

A. Flight Control Electronics System

The flight control electronics system (FCES) comprises five systems that provide warnings or supplementary control of manual aircraft functions. The FCES systems are independent of each other, except they use the same power supplies. The electronic circuits of the systems and the power supplies are housed in the FCES computer.

The FCES computer is located in the forward electronics service center, center rack, zone 112. The five systems are redundant with the exception of the fault monitor system. The systems are as follows:

(1) Stall Warning System

(2) Altitude Alert System

(3) Primary Flight Control System (PFCS) Monitor

(4) Direct Lift Control/Automatic Ground Spoiler (DLC/AGS) System

(5) Fault Isolation Monitor (FIM) (See 22-09-00).

B. Stall Warning System

The stall warning signal is generated as a function of the angle of attack, flap angle and slat position. A sensed stall warning will cause the pilots and copilots control column to shake by means of a motor driving an eccentric mass attached to the column.

C. Altitude Alert System

The altitude alert system provides visual and aural indication of aircraft approach to or deviation from a preselected altitude. Barometric corrected altitude signals are developed from servo driven synchros in the altimeters. The synchro output signals are processed to altitude error signals by comparison with selected altitude in the differential resolvers in the Altitude Select Panel. The altitude error signal from the Altitude Select Panel is processed by the FCES computer.

D. Primary Flight Control System (PFCS) Monitor

The PFCS monitor system monitors switch status signals from spring bungees in the aircraft aileron and stabilizer primary control systems. The spring bungees are similar to rigid links and when applied forces exceed the bungee preload, the bungees act like springs. Switches in the bungees detect this deformation and send this data to the FCES computer for fault detection. PFCS monitor outputs are displayed on the PFCS Control Panel.

E. Direct Lift Control/Automatic Ground Spoilers (DLC/AGS)

DLC/AGS operation provides automatic control of the spoilers during approach, landing, or aborted takeoff. DLC is provided during manual or automatic approaches. AGS is provided only during aborted takeoff and rollout operations to provide aerodynamic braking as required. The DLC/AGS system receives inputs from sensors and switches. The system provides the logic and signal conditioning to operate the DLC servos.

R F. Fault Isolation Monitor (FIM)

The FIM subsystem controls FCES related fault indicators on the FCES computer front panel. A fault indicator changes from black to yellow if a malfunction occurs in one of the autoflight subsystems. A failure in the FCES computer turns the fault indicator from black to white. See 22-09-00 for a detailed description of the FIM system.

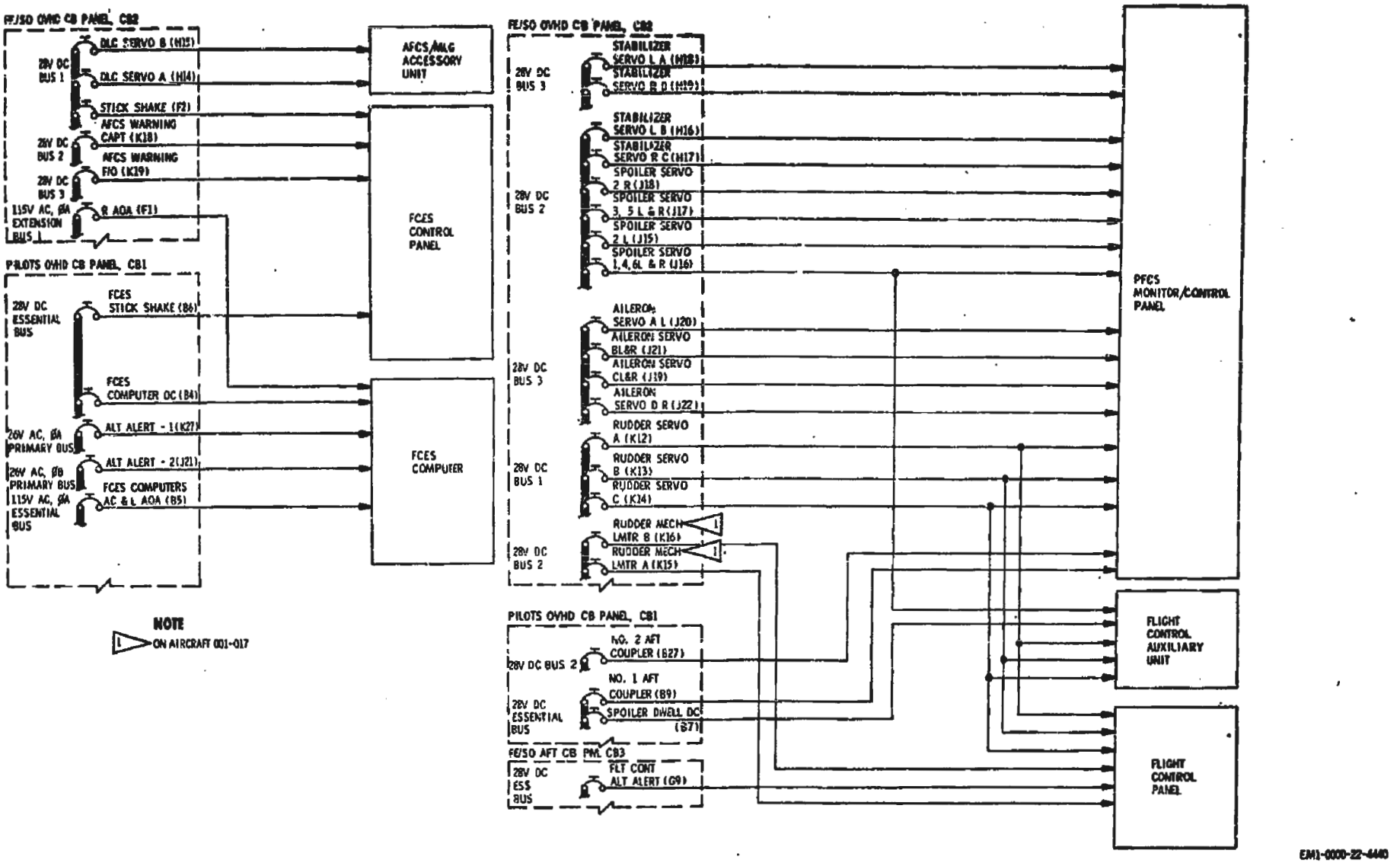
G. Power Application

The primary power distribution for the FCES components is shown in Figure 1. All circuit breakers are located on the pilots overhead circuit breaker panel CB1, zone 210, and Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215. The circuit breakers on CB1 are located on the AVIONICS FLIGHT CONTROL SYSTEM strips and the 26 VAC NAV EXCITATION strips. The circuit breakers on CB2 are located on the HYDRAULIC strips and the FLIGHT STATION MISC strip.

2. Stall Warning System

A. General

The stall warning system provides the pilots with an artificial warning of an impending stall condition. The FCES computer stall warning channels use the angle-of-attack, the flap angle position, the leading edge slat position, and the landing gear strut switch logic


F/FSO OVHD CB PANEL, CB2
28V DC BUS 1
DLC SERVO B (H15)
DLC SERVO A (H14)
STICK SHAKE (F2)
28V DC BUS 2
AFCS WARNING CAPT (K18)
AFCS WARNING F/O (K19)
28V DC BUS 3
115V AC, ØA EXTENSION BUS
R AOA (F1)
AFCS/MLG ACCESSORY UNIT
FCES CONTROL PANEL
PILOTS OVHD CB PANEL, CB1
28V DC ESSENTIAL BUS
FCES STICK SHAKE (B6)
FCES COMPUTER DC (B4)
26V AC, ØA PRIMARY BUS
ALT ALERT - 1 (K27)
26V AC, ØB PRIMARY BUS
ALT ALERT - 2 (J21)
115V AC, ØA ESSENTIAL BUS
FCES COMPUTERS AC & L AOA (B5)
FCES COMPUTER
NOTE
1 ON AIRCRAFT 001-017
F/FSO OVHD CB PANEL, CB2
28V DC BUS 3
STABILIZER SERVO L A (H18)
STABILIZER SERVO R D (H19)
28V DC BUS 2
STABILIZER SERVO L B (H16)
STABILIZER SERVO R C (H17)
SPOILER SERVO 2 R (J18)
SPOILER SERVO 3, 5 L & R (J17)
SPOILER SERVO 2 L (J15)
SPOILER SERVO 1, 4, 6L & R (J16)
28V DC BUS 3
AILERON SERVO A L (J20)
AILERON SERVO BL&R (J21)
AILERON SERVO CL&R (J19)
AILERON SERVO D R (J22)
28V DC BUS 1
RUDDER SERVO A (K12)
RUDDER SERVO B (K13)
RUDDER SERVO C (K14)
28V DC BUS 2
RUDDER MECH LMTR B (K16)
RUDDER MECH LMTR A (K15)
PFCS MONITOR/CONTROL PANEL
PILOTS OVHD CB PANEL, CB1
28V DC BUS 2
NO. 2 AFT COUPLER (B27)
28V DC ESSENTIAL BUS
NO. 1 AFT COUPLER (B9)
SPOILER DWELL DC (B7)
F/FSO AFT CB PNL CB3
28V DC ESS BUS
FLT CONT ALT ALERT (G9)
FLIGHT CONTROL AUXILIARY UNIT
FLIGHT CONTROL PANEL
EM1-0000-22-4480

R FCES Primary Power Distribution Diagram
R Figure 1

EFFECTIVITY: ALL

001B

signals to determine the stall warning condition. The resulting outputs are applied to the stick shakers.

The stall warning system is comprised of the following components (Ref. Fig. 2):

22-10-07 FCES Control Panel

22-10-11 AFCS/MLG Accessory Unit

22-17-01 FCES Computer

22-17-16 Stick Shaker

22-31-06 Angle-of-Attack (AOA) Sensors

27-51-07 No. 1 and No. 2 Switch Boxes on Flaps Power Drive Unit (PDU)

R 27-81-08 No. 1 and No. 2 Switch Boxes on Slats Power Drive Unit (PDU)

33-17-99 FLT CONT PANELS Light

B. Operation

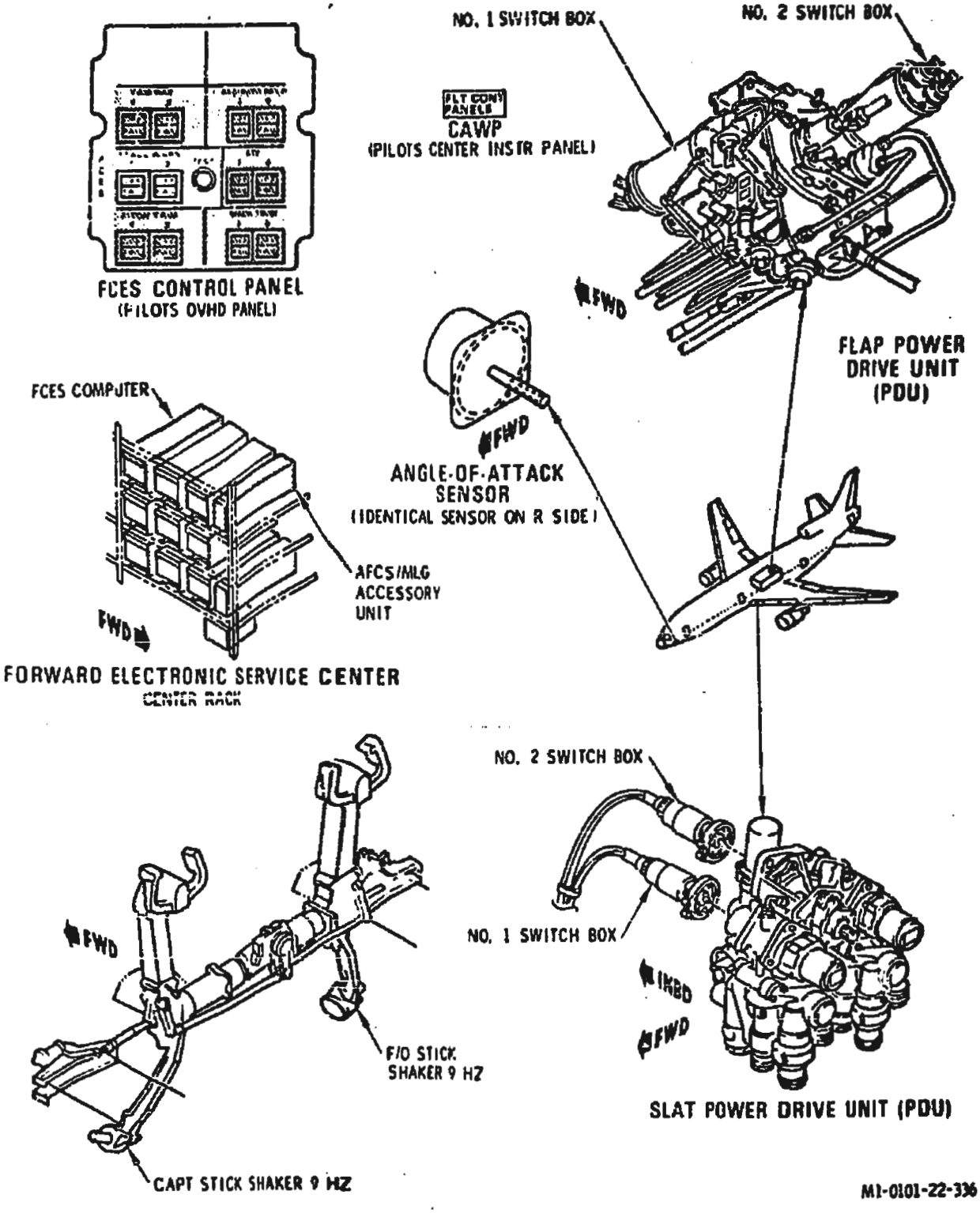
The stall warning function provides the pilots with an artificial warning of an impending stall condition. The function anticipates a stall based on dynamic conditions. The stall warning is indicated to the pilots by a vibrating control column stick shaker. The signal to operate the stick shakers is derived by two independent stall warning logic channels in the FCES computer.

(1) Engagement

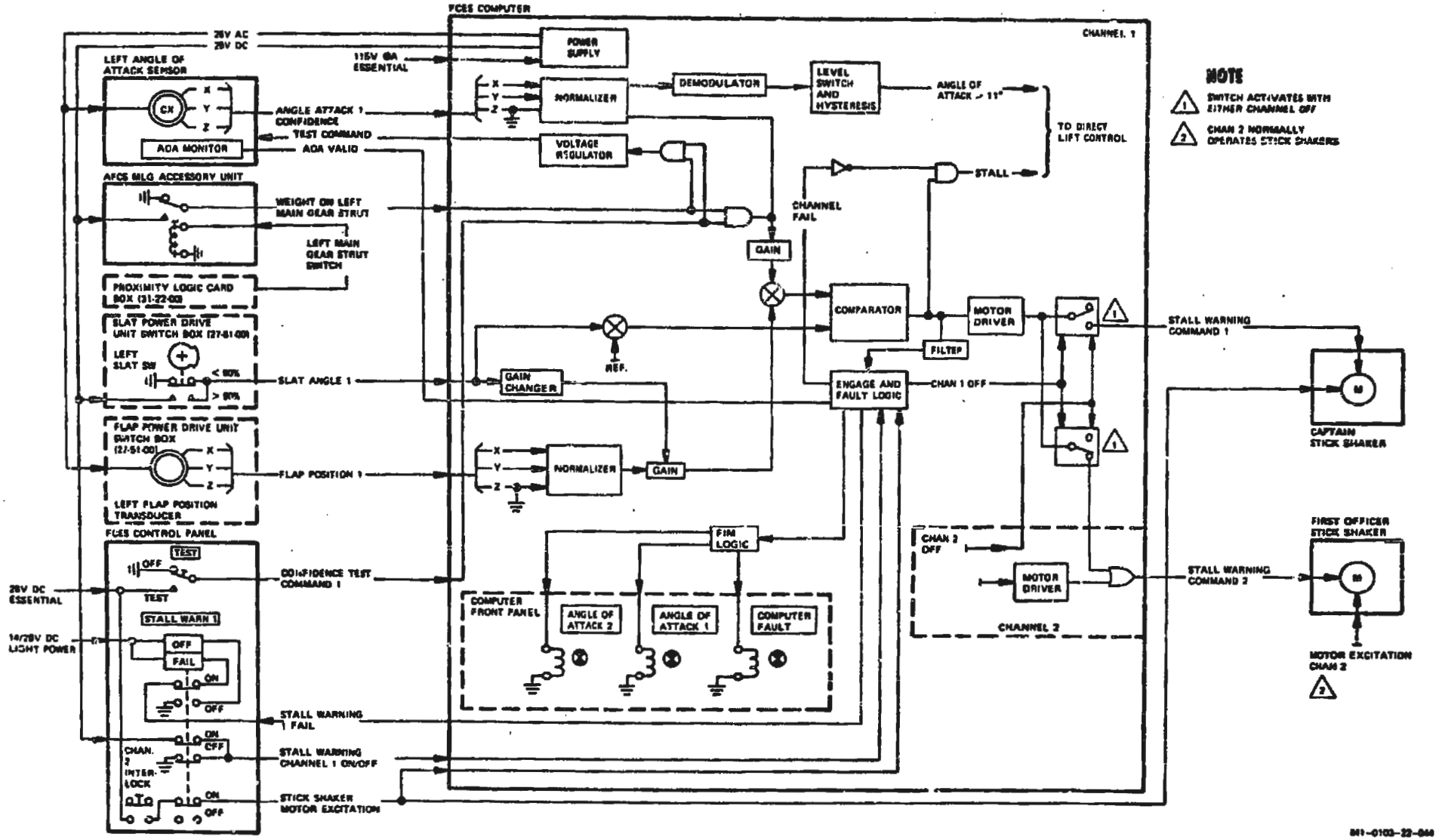
The two stall warning channels are independently engaged through the normally depressed (latched in) STALL WARN switchlights on the FCES control panel. Each switchlight (Ref. Fig. 3) receives 28V dc from the associated FCES computer power supply and applies it as the stall warning channel-on signal to the channel engage logic circuit in the computer and also as the motor drive signal to the stick shaker.

(2) Warning Logic

Each stall warning logic channel receives the angle-of-attack, the flap position, and the slat position signals. The angle-of-attack and flap position synchro signals are fed through the normalizers to remove errors due to synchro excitation



R R Stall Warning System Equipment and Location
Figure 2



R Stall Warning Functional Block Diagram
R Figure 3

EFFECTIVITY: ALL

001B

and transformation ratio. The normalized angle-of-attack and flap position signals are summed, and the summed signal is compared against a reference. When the summed signal exceeds the set limits, the stick shaker motor driver is switched on to produce a stall warning signal. The slat angle signal controls the gain of the normalized flap position signal. The slat angle signal also changes the reference to the comparator so that the stall warning occurs at a lower angle-of-attack when the slats are not deployed.

The stall warning signal is a 28V dc signal which drives the stick shaker motor. The motor rotates an out-of-balance ring which causes the control column to vibrate at a low amplitude. When driven, both the Captains and First Officers stick shakers produce a frequency of 9 Hz with an amplitude of ±0.1 inch at the control wheels.

Although both channels are computing, the cross channel logic circuit applies an output to the First Officers stick shaker only. The channel corresponding to the Captains stick shaker is on active standby until a failure causing disengagement of the First Officers channel occurs.

The stall warning output to the direct lift control (DLC) function causes automatic retraction of the spoilers (if extended for use). The warning affects the DLC operation if the angle-of-attack is greater than 11 degrees as detected by an 11-degree level switch, and if the stall warning system is free of detected failures. The hysteresis included in the level switch prevents redeployment of the spoilers until the angle-of-attack is reduced below 8 degrees.

When the aircraft is on the ground, the stall warning channels receive main landing gear strut switch (weight-on-gear) logic signals from the AFCS/MLG accessory unit. The signal inhibits the channel outputs preventing stick shaker vibration on the ground and allows confidence testing.

(3) Confidence Test

A TEST switch on the FCES control panel is used for stall warning confidence testing on the ground. When the switch is depressed, the logic signal allows the angle-of-attack sensors to be driven to simulate a stall. The simulated stall causes the stick shaker to vibrate if the associated channel is turned on.

(4) Failure Status

When a failure is detected in the input sensors, the computer stall warning channel, or the stick shaker, the affected stall warning channel engage logic circuit automatically disengages the channel and sends a fail logic signal to the associated STALL WARN switchlight. The signal causes the FAIL message on the switchlight
R to come on. The FLT CONT PANELS light on the caution
R and warning panel flashes to alert the pilots that a message is indicated on the FCES control panel. The failure-affected channel is turned off by momentarily depressing the switchlight, which causes the FAIL
R message to go out and the OFF message to come on. The
R FLT CONT PANELS light goes out when the C/W ANN RESET switch is depressed. The first channel failure does not affect the operation of the second channel or other system functions.

C. Angle-of-Attack Sensor

There are two angle-of-attack (AOA) sensors, one located on the left forward fuselage, and the other on
R the right forward fuselage (Ref. Fig. 2). The left
R sensor provides an AOA position signal and an AOA valid signal to the No. 1 stall warning system. The right sensor provides position and valid signals to the No. 2 system. For a detailed description of the AOA sensor, see 22-31-00.

D. Slats PDU No. 1 and No. 2 Switch Boxes

There are two switch boxes (Ref. Fig. 2) located on the slats power drive unit (PDU). The No. 1 switch box contains the slat position switch used with stall warning system No. 1. The switch provides a ground output when slats are less than 90-percent deployed, and provides a 28V dc output when slats are equal-to or greater-than 90-percent deployed. The No. 2 switch box contains the slat position switch used with stall warning system No. 2. For a detailed description of the slats PDU, see 27-81-00.

E. Flaps PDU No. 1 and No. 2 Switch Boxes

There are two switch boxes (Ref. Fig. 2) located on the flaps power drive unit (PDU). The No. 1 switch box contains the flap position synchro used with stall warning system No. 1. The synchro provides a signal proportional to flap angle position. The No. 2 switch box contains the flap position synchro used with stall

warning system No. 2. For a detailed description of the flaps PDU, see 27-51-00.

F. FCES Control Panel

The FCES control panel is located in the pilots overhead panel (Ref. Fig. 2). The panel contains the STALL WARN 1 and 2 switchlights (on/OFF controls with FAIL legend), and the stall warning system TEST switch. For a detailed description of the FCES control panel, see 22-10-00.

G. Stick Shaker

There are two stick shakers (Ref. Fig. 4). One is mounted on the Captains control column and the other on First Officers control column. The stick shakers provide the pilots with an artificial stall warning signal which supplements the natural aircraft buffet when approaching a stall. The intelligence to operate the stick shakers is derived from a combination of angle-of-attack, landing gear position, slat position, and flap position. Dual sensors are used for fail safety and the Captains and First Officers systems are independent. The shakers are mounted to the bottom of the control columns and vibrate the control columns when energized by a signal from the flight control electronics system (FCES) computer.

The shaker is composed of a dc motor and a coaxially mounted weighted ring. Energizing the motor rotates the out-of-balance ring and causes the control column to vibrate at a low amplitude. Each stick shaker vibrates the associated control column at approximately 9 Hz.

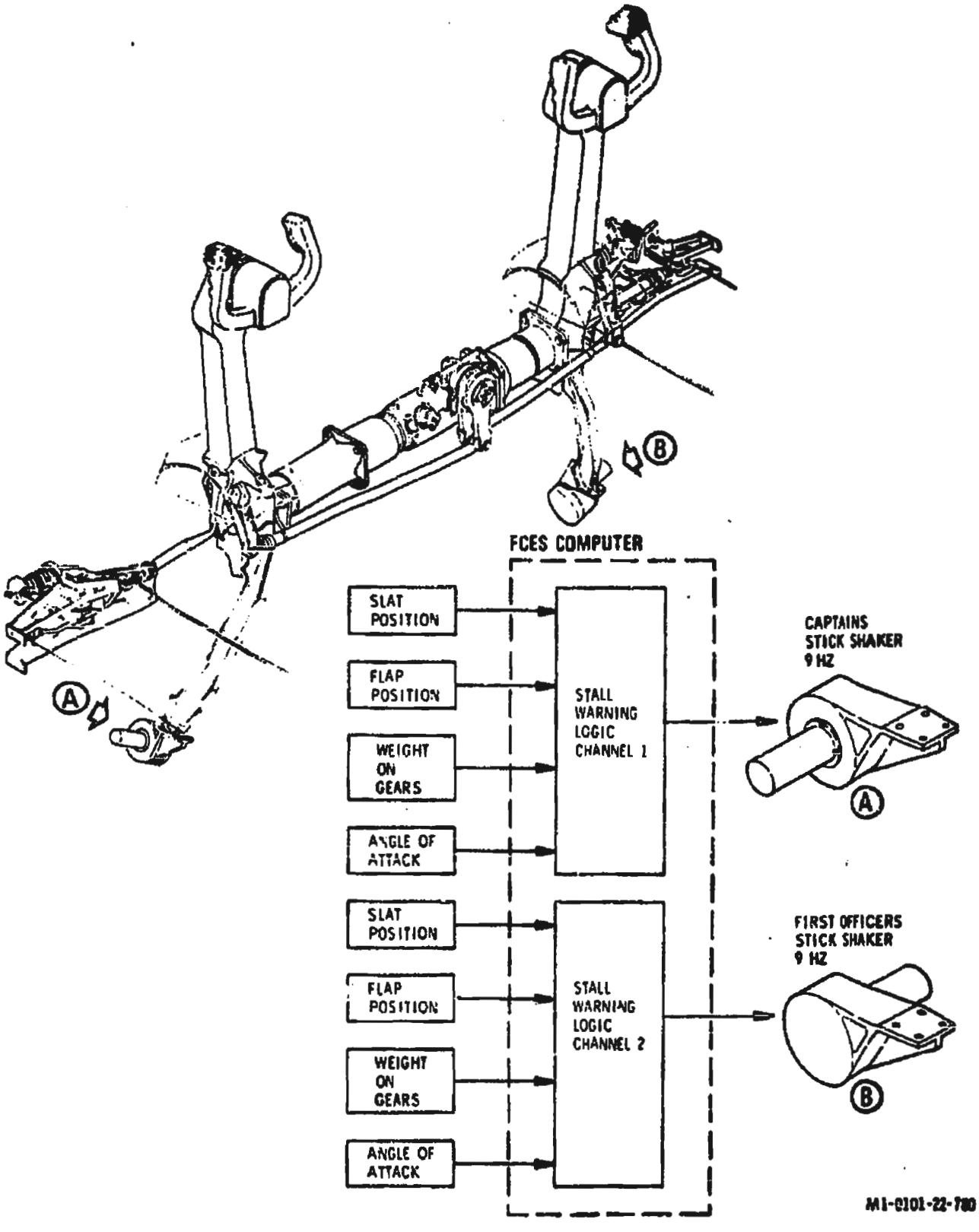
H. AFCS/MLG Accessory Unit

The AFCS/MLG accessory unit is located in the forward electronic service center, center rack (Ref. Fig. 2). The unit provides the stall warning system, a signal that indicates whether the aircraft is airborne or on the ground. Removal of the unit during ground testing simulates aircraft airborne. The airborne signal inhibits the stall warning confidence TEST function. For a detailed description of the unit, see 22-10-00.

I. FCES Computer

R See Paragraph 6.

J. FLT CONT PANELS Indicator Light



R
R

Stick Shaker
Figure 4

EFFECTIVITY: ALL

001B

The FLT CONT PANELS indicator light is located on the pilots center instrument panel, caution and warning panel (Ref. Fig. 2). The indicator comes on when either or both STALL WARN FAIL legends on the FCES control panel come on.

3. Altitude Alert System

A. General

The altitude alert system provides visual and aural alerts of aircraft movement with respect to pilot selected altitudes. Aircraft approach to the altitude, on-altitude, or altitude deviation is indicated by the altitude alert indicators, with an aural tone heard when the aircraft crosses a predetermined level with respect to a selected altitude. The altitude alert channels operate using the barometric altitude inputs through the altitude select panel.

The altitude alert system is comprised of the following components (Ref. Fig. 5):

22-11-01 Pitch Computer

22-11-03 Altitude Select Panel

22-11-04 Altitude Alert Lights

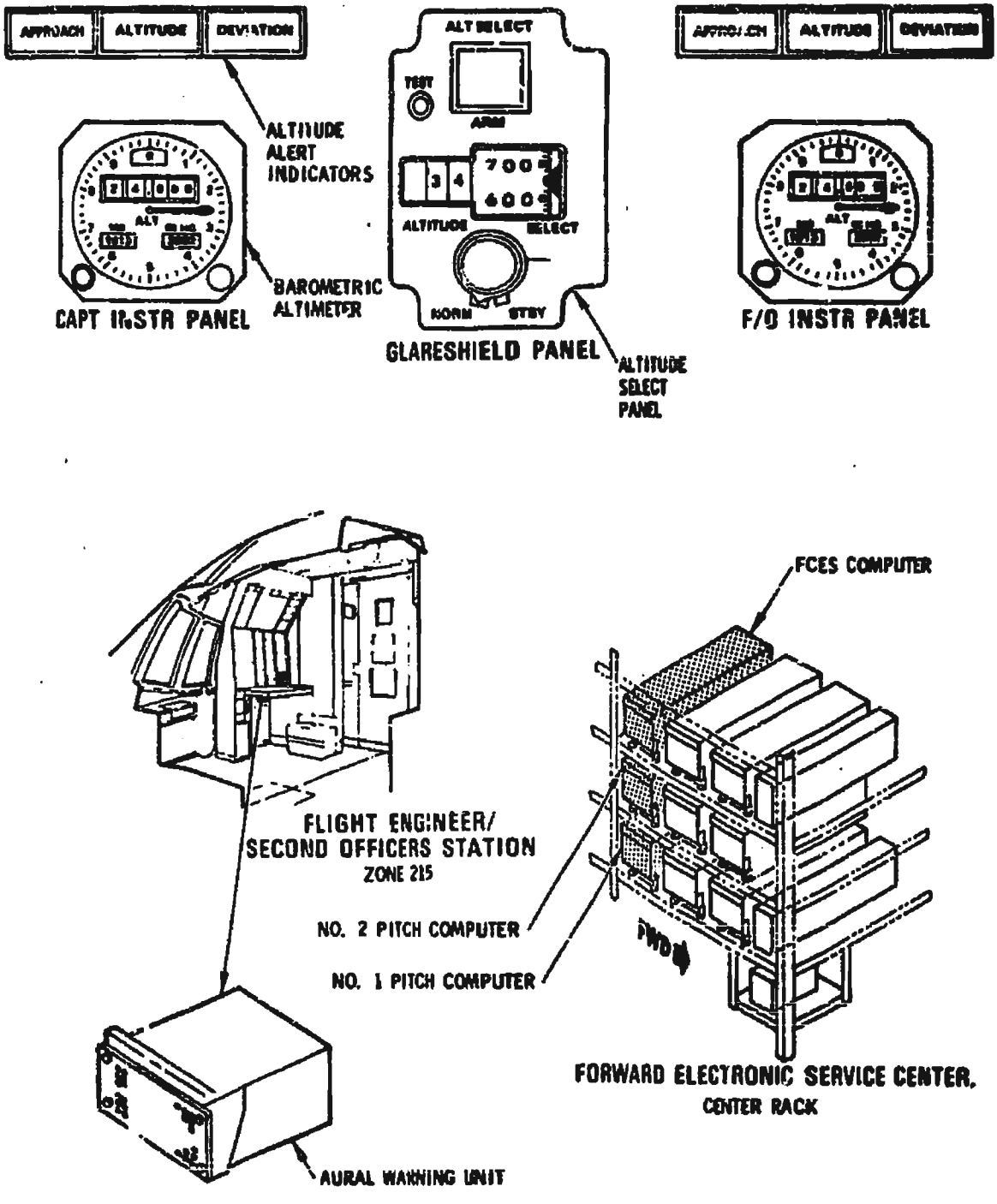
22-17-01 FCES Computer

31-22-03 Aural Warning Box

34-14-03 Barometric Altimeter

B. Operation

The altitude alert function (Ref. Fig. 6) provides visual and aural indications when the aircraft approaches, reaches, and deviates from the selected altitude. The function is performed by two identical altitude alert channels (normal and standby) in the FCES computer. The visual altitude alert is provided by the altitude alert indicators (APPROACH, ALTITUDE, and DEVIATION) located on both the
R Captains and First Officers instrument panels. The Captains
R and First Officers altitude alert indicators are hard wired
R together. The aural alert is heard through the aural warning box (Ref. 31-22-00). The Captains and First
R Officers barometric altimeters (Ref. 34-14-00) provide the
R altitude signals used to determine the alert condition.



M1-0101-22-337

R R Altitude Alert System Equipment and Location
Figure 5

The NORM/STBY switch on the ALT SELECT panel is used mainly to select one altitude alert channel, normal (channel No. 1) or standby (channel No. 2). The selected channel provides altitude error and barometric altimeter valid outputs to the pitch computer for use in the altitude select mode (Ref. 22-11-00). The altitude alert function is not affected by the channel selection except that the aural alert signal to the aural warning box is provided by the selected channel only.

When the aircraft approaches 1000 feet above (descending) or below (ascending) the selected altitude, each altitude alert channel provides a logic signal to turn on the associated amber APPROACH indicator (Ref. Fig. 7). When the aircraft reaches 500 feet above or below the selected altitude, either altitude alert channel sends a spike voltage to the aural warning box to trigger a 0.5-second C-chord tone. At 250 feet above or below the selected altitude, the APPROACH indicators go off and the green ALTITUDE indicators come on. The ALTITUDE indicators remain on as long as the aircraft is within 250 feet of the selected altitude.

When the aircraft crosses the 250-foot level in deviating direction, either above or below, the 0.5-second C-chord is heard. At same time, the alert channels cause the ALTITUDE indicators to go off. If the aircraft continues to deviate and reaches the 500-foot deviation, the red DEVIATION indicators start flashing. The flashing continues until the deviation is reduced to less than 250 feet, or until a new altitude is selected on the ALT SELECT panel.

The altitude alert system ground test capability is provided by the TEST switch on the ALT SELECT panel. With the TEST switch held depressed and by adjusting the altitude selector, an altitude error signal relative to the existing barometric altitude indicator setting is generated. Adjustment of the altitude selector to the altitude alert levels triggers the proper annunciations and aural warning.

C. Pitch Computer

Two pitch computers are located on the center rack in the forward electronic service center. Pitch computer No. 1 is used with autopilot A and pitch computer No. 2 with autopilot B. The pitch computers utilize altitude error signals (barometric altitude vs selected altitude) from the FCES computer when the autopilot is armed for automatic altitude capture. The valid FCES PWR and ALT VALID signals from the FCES computer are required by the pitch computers before the altitude select mode can be armed. For a detailed description of the pitch computers, see 22-11-00.

D. Altitude Select Panel

The ALT SELECT panel is located on the right side of the glare shield panel (Ref. Fig. 5). The panel contains an ALT SELECT knob and indicator which is used to preselect the desired altitude. A red warning flag comes into view when either a FCES computer power failure is detected, or a barometric altimeter valid signal is lost. For a detailed description of the altitude select panel, see 22-11-00.

E. Altitude Alert Lights

There are six altitude alert lights, three located on the Captains instrument panel and three on the First Officers instrument panel (Ref. Fig. 5). The amber APPROACH lights come on when the aircraft is between 1000 and 250 feet of the selected altitude. The green altitude lights come on when the aircraft is within 250 feet of the selected altitude. The flashing red DEVIATION lights come on when the aircraft deviates over 500 feet from the selected altitude.

F. FCES Computer

R See Paragraph 6.

G. Aural Warning Box

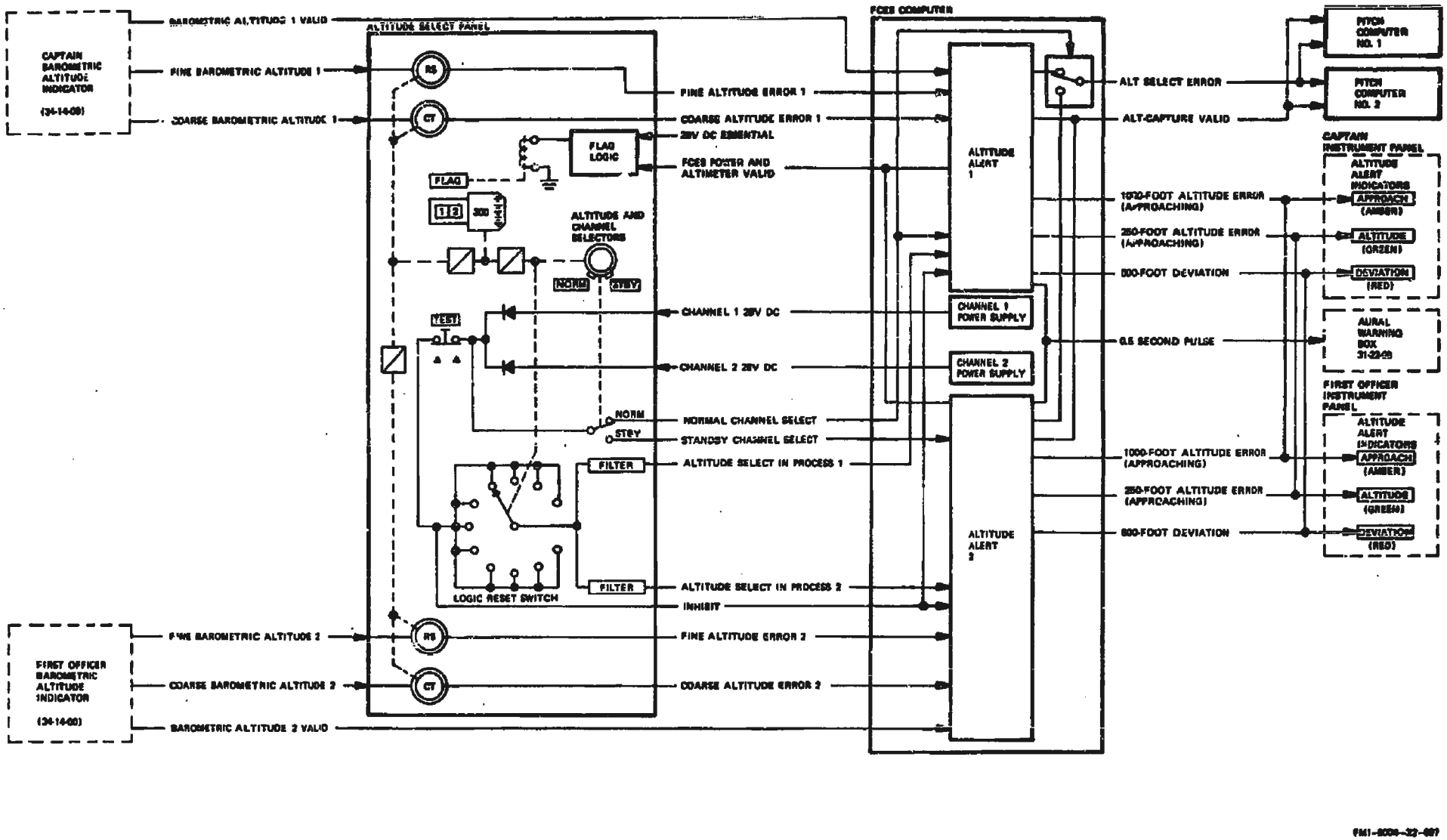
The aural warning box is located on the underside of the flight officers/second officers table (Ref. Fig. 5). The box provides the 0.5-second C-chord tone when the aircraft is 500 feet from the selected altitude when approaching, and when the aircraft is 250 feet from the selected altitude when deviating. For a detailed description of the aural warning box, see 31-22-00.

H. Barometric Altimeter

There are two barometric altimeters, one located on the Captains instrument panel and the other on the First Officers instrument panel (Ref. Fig. 5). The Captains instrument provides barometric altitude for NORM altitude alert channel. The First Officers instrument provides barometric altitude for the STBY altitude alert channel. In addition, each barometric altimeter provides the FCES computer with a valid signal. For a detailed description of the barometric altimeters, see 34-14-00.

4. Primary Flight Control System (PFCS) Monitor System

A. General



R Altitude Alert Functional Block Diagram
R Figure 6

EFFECTIVITY: ALL

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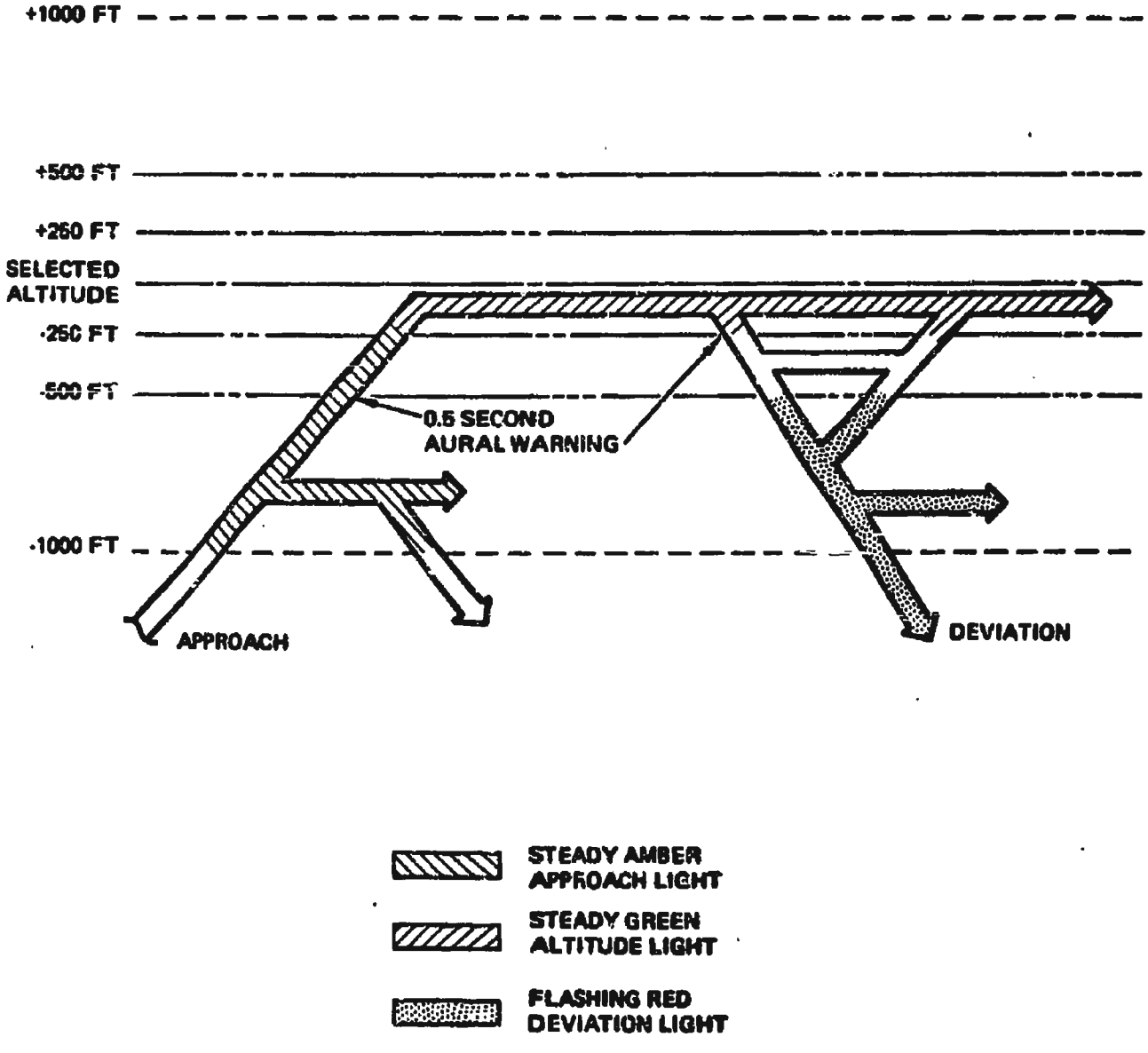

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R
R

Altitude Alert System Operation
Figure 7

EFFECTIVITY: ALL

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The PFCS monitoring system is comprised of two subsystems which monitors the primary flight pitch axis controls, and the primary flight roll axis controls. The FCES computer PFCS monitoring channels receive fault inputs from bungees and switches in the pitch and roll axis control paths and determine the action commands to be annunciated on the PFCS monitor/control panel. The panel provides the pilot with commands to decouple the affected flight control path and to shut off hydraulic power to the affected primary flight control surface servos.

The two subsystems monitoring the primary flight controls are as follows:

(1) Pitch Axis Monitoring Subsystem

(2) Roll Axis Monitoring Subsystem

B. Pitch Axis Monitoring Subsystem

(1) General

The pitch axis monitoring subsystem detects jams, opens and other failures in the pitch axis primary flight controls. It displays warning and corrective actions on the PFCS monitor/control panel.

The pitch axis monitoring subsystem is comprised of the following components (Ref. Fig. 8).

22-17-01 FCES Computer

22-17-02 PFCS Monitor/Control Panel

27-41-06 Pitch Bungee Switch

27-41-12 Pitch Aft Coupler Assembly

27-41-22 Solenoid Shutoff Valve (Stabilizer Servos L and R)

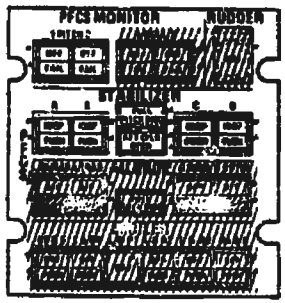
27-41-32 Pitch Cable Break Detector Switch

27-41-39 By-Pass Valve Switch(Stabilizer Servo L and R)

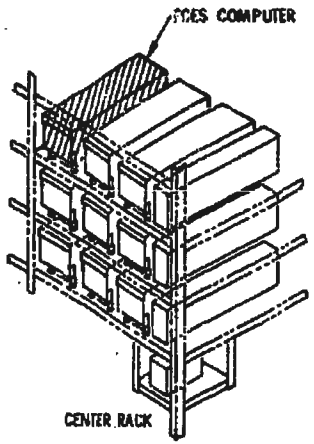
27-41-40 Pitch Aft Coupler Switch Assembly

(2) Operation

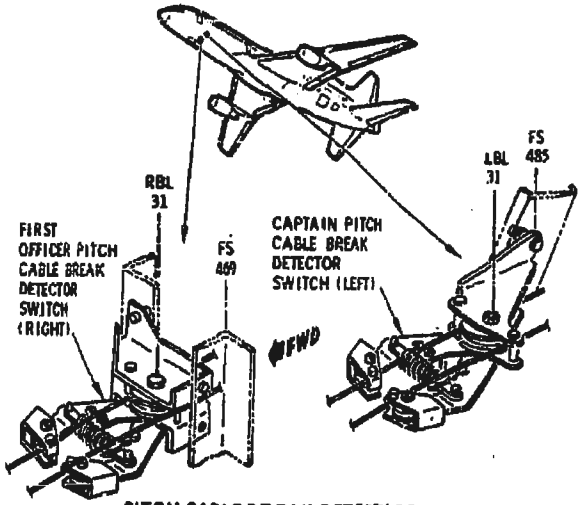
(a) Engagement



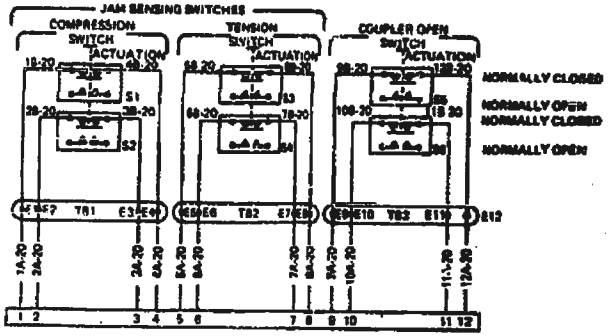
PFCS MONITOR/CONTROL PANEL



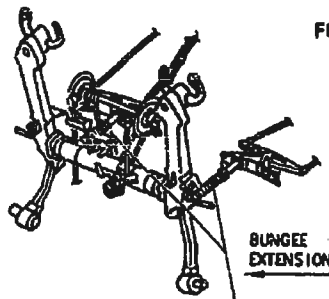
FORWARD ELECTRONIC SERVICE CENTER

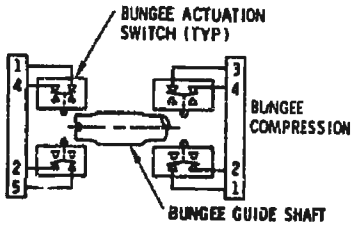


PITCH CABLE BREAK DETECTORS

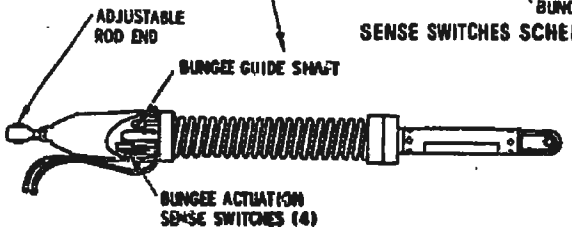


PITCH AFT COUPLER WIRING SCHEMATIC

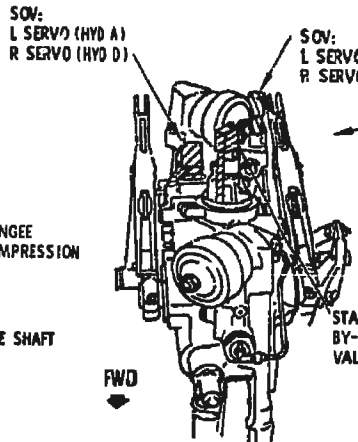




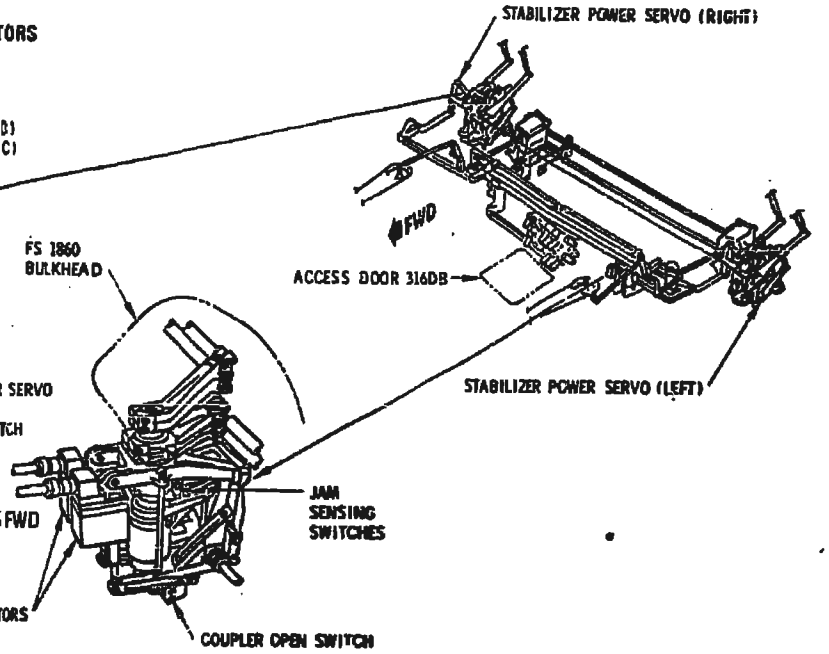
SENSE SWITCHES SCHEMATIC



PITCH BUNGEE SWITCH



STABILIZER POWER SERVO (TYPICAL) (VIEW LOOKING UP)



PITCH AFT COUPLER ASSEMBLY

M1-003-22-388

R Pitch Axis Monitoring Subsystem Equipment and Location
R Figure 8

EFFECTIVITY: ALL

001B

The two FCES computer pitch axis monitoring channels are independently engaged through the normally depressed (latched in) PFCS MONITOR PITCH 1 and 2 switchlights on the PFCS monitor/control panel. The two PITCH switchlights control the pitch axis monitor channels. Each switchlight receives 28V dc from the associated FCES computer power supply.

The 28V dc is applied to both the on and off contacts of the switchlight. When the switchlight is depressed, the 28V dc is applied to the associated FCES computer monitor channel on-logic circuit. If the switchlight is released (out), the 28V dc is applied to the channel off-logic circuit to turn off the channel. Channel turn-off is indicated by the switchlight OFF message.

(b) Pitch Axis Monitoring

The pitch axis monitoring subsystem (Ref. Fig. 9) relies on detecting switches incorporated in the control column output spring bungee and pitch cable break detector in each stabilizer control path, and the pitch aft coupler assembly (Ref. 27-41-00). The spring bungee consists of two extension and two compression switches, one each of which is connected to each of the monitoring system channels. When a force due to a jam in extended or compressed direction exceeds the bungee breakout, the bungee compresses and actuates the associated set of switches. The pitch cable break detector consists of two double-pole switches cross-connected to both monitoring system channels. The switches actuate when a breakage in the pitch control cable system is detected. The pitch aft coupler assembly consists of a two-pole tension switch and a two-pole compression switch, each of which is connected to both monitoring system channels. One or the other switch actuates when a jam occurs in a stabilizer control path.

The detecting switches, which are normally closed, apply 28V dc from the associated FCES computer channel power supply to the computer stabilizer control monitoring circuit. When a jam occurs in a stabilizer control path, the actuated switches in the spring bungee and the pitch aft coupler assembly open-circuit the 28V dc signal paths to the monitoring circuits. Also, when an open pitch control cable occurs, the actuated switches in the

R pitch cable break detector open-circuit the 28V dc signal paths to the monitoring circuits. In either case, the monitoring circuits sense the loss of the signals and send push command signals to the PFCS monitor/control panel to light the PUSH legend on STABILIZER switchlights A and B, or C and D. By depressing the affected pair of switchlights, a 28V dc signal energizes the associated servo shutoff solenoids which control
R the position of the stabilizer power servo bypass valves to shut down the entire stabilizer servo. The servo bypass valve action closes the associated valve switches, which causes a 28V dc (servo in bypass) signal to be applied to both computer stabilizer control logic circuits. The signal enables each logic circuit to turn on the INOP legend on the same switchlights to indicate the inoperative status of the associated stabilizer servo. An INOP message also comes on (without getting PUSH command) as a result of loss of hydraulic pressure or actuation of a stabilizer servo valve jam mechanism.

As the stabilizer servo shutdown is commanded, the same set of the STABILIZER switchlights (A & B or
R C & D) sends decoupling command signals to the
R pitch aft coupler linear actuators to decouple the coupler. When the coupler is decoupled, the switches associated with the coupler send a coupler open signal to the monitor channels. The monitor channels send a signal to the PFCS monitor/control panel to light the AFT CPLR OPEN
R indicator. The aft coupler linear actuator sends a 28V dc signal to the FCES computer when the actuator is fully open. The signal inhibits the push command signal to the PFCS monitor/control panel switchlights, which causes the PUSH legend to go out.

At the same time the aft coupler open signal is sent to the PFCS panel, the stabilizer control monitor channels also send a pitch coupler pull command signal to light the PULL PITCH DISC indicator. The illuminated PULL PITCH DISC is an advisory message to disconnect the forward pitch coupler to improve aircraft pitch feel characteristics. Once disconnected, the PITCH DISC message on the PITCH DISC handle will illuminate. The aircraft can be controlled in pitch by only one control column.

The pitch aft coupler is recoupled, after a fault is corrected, by depressing (latching in) all STABILIZER switchlights into the normal state. The switchlights in normal state provide coupling command signals to the coupler actuators to engage the coupler.

A disagreement between the pitch cable break detector switches in the pitch axis monitor channel turns on the PITCH (1 or 2) FAIL legend on the PFCS monitor/control panel. A disagreement between the bungee switches in the pitch axis monitor channel is inhibited in the air, but turns on the PITCH (1 or 2) FAIL legend as soon as the aircraft is on the ground. The fail signal also causes the FLT CONT PANELS master caution indicator to flash alerting the pilots to a fail indication on the control panel. By depressing the switchlight, the FAIL legend goes out and the OFF legend comes on, indicating channel turn-off. The master caution indicator can be turned off by depressing the C/W ANN RESET switch. Operation of the second channel is not affected by the failure.

(3) FCES Computer

R See Paragraph 6.

(4) PFCS Monitor/Control Panel

R See Paragraph 7.

(5) Pitch Bungee Switch

There are four mechanically actuated pitch bungee switches installed on each pitch override bungee. The two pitch override bungees are installed between their respective (Captains and First Officers) control column and cable driver bellcrank (Ref. Fig. 8). The pitch bungee switches determine if the bungee is being compressed (indicating a restriction in the cable control path), and what kind of a load (compression or tension) is causing its actuation. The switch signals are fed to the FCES computer, which actuates the PULL PITCH DISC indicator and the affected stabilizer servo switchlights on the PFCS monitor control panel. For a detailed description of the pitch bungee switches, see 27-41-00.

(6) Pitch Aft Coupler Assembly

The pitch aft coupler assembly is installed in series with the pushrod linkage that connects the Captains and First Officers stabilizer servo control paths in the afterbody (Ref. Fig. 8). The coupler is a clutch operated mechanism which provides for decoupling the two stabilizer servo control paths in the event of a control path jam to allow continuous pilots control of the stabilizer. Decoupling/recoupling of the coupler is achieved electrically by the PFCS control panel. For a detailed description of the aft coupler, see 27-41-00.

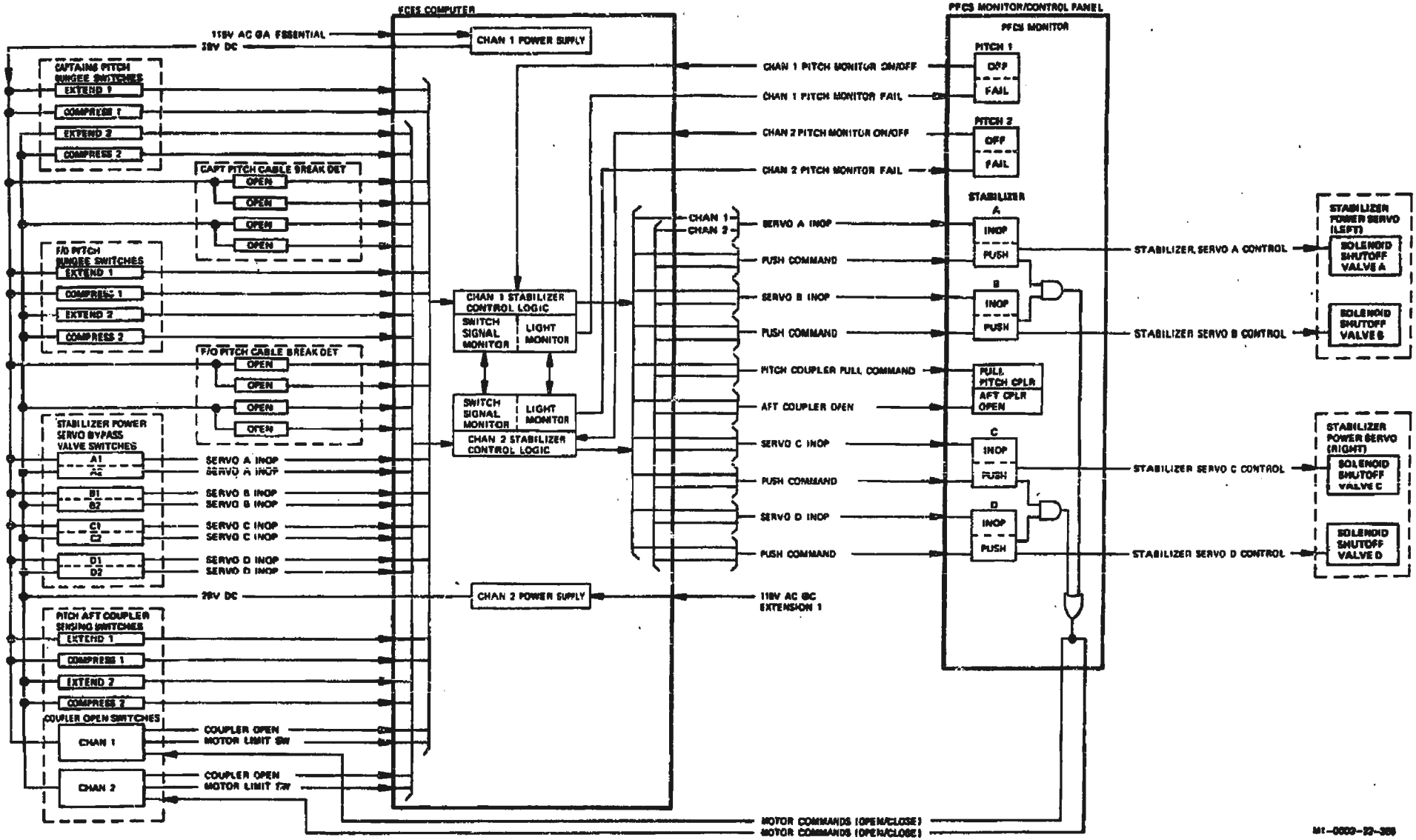
(7) Pitch Aft Coupler Switches

There are six aft coupler switches located on the pitch aft coupler assembly and one limit switch located in each electrical linear actuator (Ref. Fig. 8). The four JAM SENSING switches sense either compression or tension condition between the two input arms of the pitch aft coupler assembly. The FCES computer logic uses the JAM SENSING switch signals in conjunction with the pitch bungee switch signal to provide stabilizer servo shutdown command indications on the appropriate STABILIZER switchlight of the PFCS control panel. The affected stabilizer servo is then shut down by releasing the switchlight.

Releasing the STABILIZER switchlights also causes a decouple command signal to the pitch aft coupler assembly linear actuators. When the pitch aft coupler is decoupled, the coupler-open switches on the pitch aft coupler assembly turn on the AFT CPLR OPEN light located on the PFCS MONITOR control panel. Also, the pitch aft coupler linear actuator limit switches send a signal to the FCES computer to inhibit the JAM indication. For a detailed description of the pitch aft coupler assembly switches, see 27-41-00.

(8) Solenoid Shutoff Valve (Stabilizer Power Servos L and R)

There are two solenoid operated shutoff valves (Hyd A and B) located on the left stabilizer power servo. There are two shutoff valves (Hyd C and D) on the right servo. Energizing the solenoid shutoff valve hydraulically positions the bypass and shutoff valve, which shuts off hydraulic flow to the control valve. The solenoid shutoff valve is controlled by STABILIZER A, B, C, D switchlights on the PFCS monitor panel. There is one switchlight for each of the four solenoid shutoff valves in the servo. For a detailed



R Pitch Axis Monitoring Subsystem Functional Block Diagram
R Figure 9

EFFECTIVITY: ALL

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description of the solenoid shutoff valve, see 27-41-00.

(9) Pitch Cable Break Detector

A pitch cable break detector is installed in both the Captains and First Officers pitch cable runs to detect a slack or broken cable. The cable break detectors are located in the ceiling in the forward end of the forward cargo compartment (Ref. Fig. 8). When the Captains pitch cable breaks, the captains detector turns on the STABILIZER A and B PUSH legends. When the first officers pitch cable breaks, the First Officers detector turns on the STABILIZER C and D PUSH legends. The FLT CONT PANELS light will flash for 10 seconds and then go steady on when a cable break fault is detected. For a detailed description of the pitch cable break detector, see 27-41-00.

(10) By-Pass Valve Switch

There are two by-pass valve switches, one for hydraulic system A and one for system B, located on the left stabilizer power servo. There are two switches, one for System C and one for System D, located on the right servo. The switches are closed with low hydraulic pressure, and are open with high pressure. When any one of the switches sense low pressure, the corresponding STABILIZER A, B, C, or D INOP switchlight comes on. For a detailed description of the by-pass valve switch, see 27-41-00.

C. Roll Axis Monitoring Subsystem

(1) General

The roll axis monitoring subsystem detects jams and other failures in the roll axis primary flight controls. It displays warning and corrective actions on the PFCS monitor/control panel.

The roll axis monitoring subsystem is comprised of the following components (Ref. Fig. 10):

22-17-01 FCES Computer

22-17-02 PFCS Monitor/Control Panel

27-11-06 Roll Torque Limiter Switches

27-11-20 Aileron Servo Solenoid Shutoff Valves

27-61-08 Spoiler Control Servo Solenoid Shutoff Valves

(2) Operation

(a) Engagement

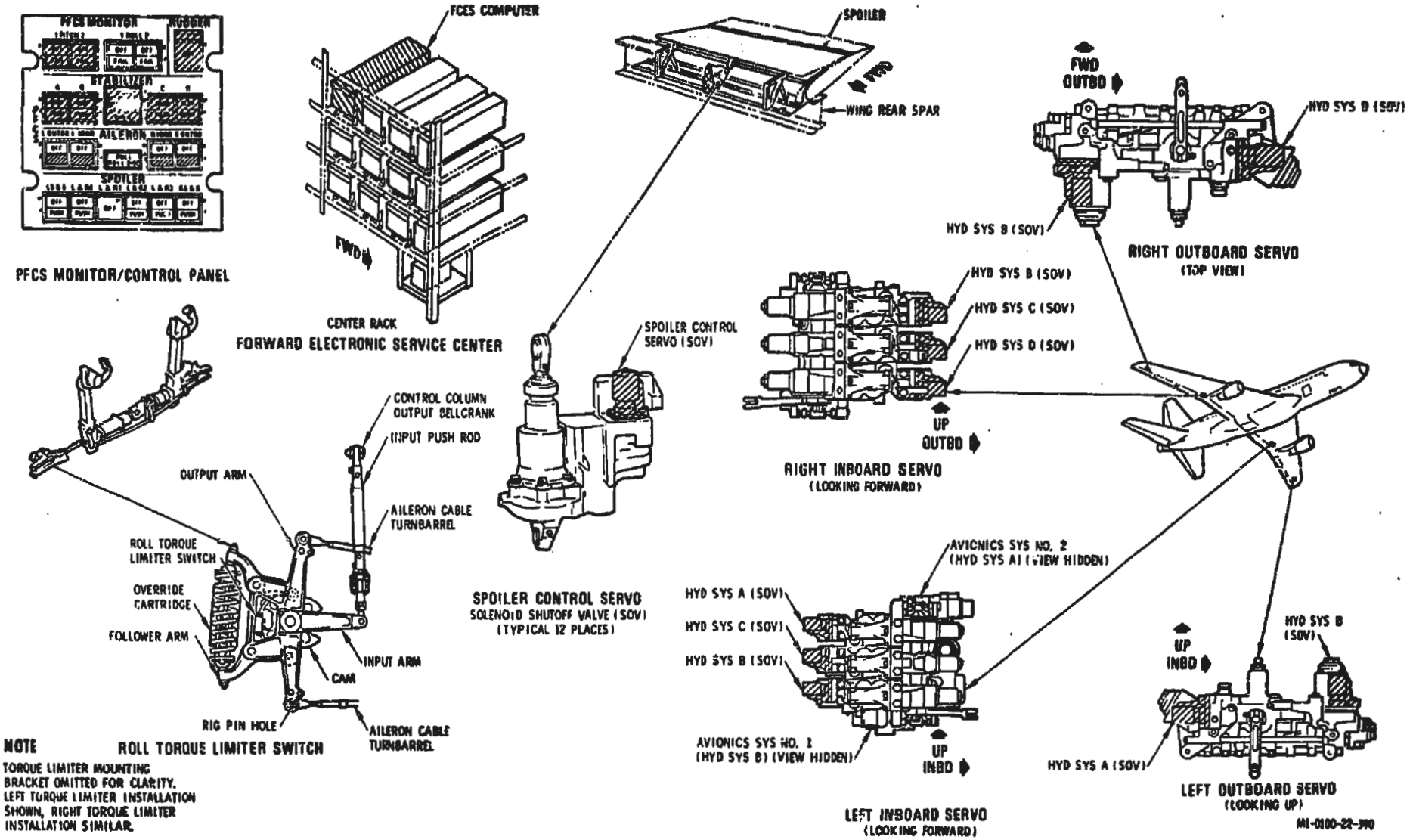
The two FCES computer roll axis monitoring channels are independently engaged through the normally depressed (latched in) PFCS MONITOR ROLL 1 and 2 switchlights on the PFCS monitor/control panel. The two ROLL switchlights control the roll axis monitor channels. Each switchlight receives 28V dc from the associated FCES computer power supply.

The 28V dc is applied to both the on and off contacts of the switchlight. When the switchlight is depressed, the 28V dc is applied to the associated FCES computer monitor channel on-logic circuit. If the switchlight is released (out), the 28V dc is applied to the channel off-logic circuit to turn off the channel. Channel turn-off is indicated by the switchlight OFF message.

(b) Roll Axis Monitoring

The roll axis of the PFCS consists of a bungee in the Captains and in the First Officers control paths. If either control path jams, forces applied on the control wheels compress the applicable bungee. The bungee consists of compression-detecting switches associated with the roll axis monitoring channels. The switches, which are normally closed, apply a 28V dc signal from the associated FCES computer channel power supplies to the computer aileron control logic circuits. When a bungee compresses as a result of a jam, the corresponding switches are opened. The logic circuits sense the loss of the 28V dc signal and send advisory signals to the PFCS monitor/control panel to light the message on the applicable switchlights in the AILERON and SPOILER sections.

A jam in the Captains control path causes the striped half of the AILERON L OUTBD and L INBD switchlights and PUSH legend on the SPOILER L5 & 6, and L & R4 switchlights to come on. A jam in the First Officers control path causes the striped half of the AILERON R OUTBD and R INBD switchlights and PUSH legend on the SPOILER R5 & 6, L & R3, and L & R2 switchlights to come on. At



R Roll Axis Monitoring Subsystem Equipment and Location
R Figure 10

EFFECTIVITY: ALL

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the same time, the PULL ROLL DISC indicator comes on.

Servo shutdown is commanded by depressing the affected switchlights to OFF. Servo shutoff solenoids are energized shutting off hydraulic pressure to the associated servo.

The illumination of the striped half of the AILERON switchlights gives the pilot discretion to shut down the associated aileron control servos. The PULL ROLL DISC indication urges the pilot to disconnect the forward roll coupler. In response to the command, the roll coupler disconnect handle can be pulled to improve the aircraft roll feel characteristics. Once disconnected, the ROLL DISC light on the ROLL DISC handle will illuminate, and the aircraft roll can only be controlled by one control wheel.

A failure in a roll axis monitor channel causes disengagement of that channel in same manner as the pitch monitor channels. The failure indication and channel turn-off indication is provided by the PFCS MONITOR ROLL 1 or 2 switchlight on the PFCS monitor/control panel.

(3) FCES Computer

See Paragraph 6.

(4) PFCS Monitor/Control Panel

See Paragraph 7.

(5) Roll Torque Limiter Switches

There are two roll torque limiter switches. One switch is located on the output arm of the Captains torque limiter assembly, and one on the First Officers torque limiter assembly (Ref. Fig. 10). The switch is actuated when a jam occurs in the roll axis control system. A detected Captains roll axis jam will cause: the striped portion of the AILERON L OUTBD and L INBD legends to come on; and the PUSH legends on the SPOILERS, L5 & 6 and L & R4 switchlights to come on. A detected First Officers roll axis jam will cause: the striped portion of the AILERON R OUTBD & R INDBD legends to come on; and the PUSH legends on the SPOILERS L & R2, L & R3 and R5 & 6 switchlights to come on. For a detailed description of the roll torque limiter switches, see 27-11-00.

(6) Aileron Servo Solenoid Shutoff Valves

There are ten aileron solenoid shutoff valves. Three on each inboard aileron servo and two on each outboard aileron servo (Ref. Fig. 10). Energizing the aileron servo solenoid shutoff valve hydraulically positions the bypass and shutoff valve to the shutoff position, thus shutting down that system. The aileron servo solenoid shutoff valves are controlled by switchlights on the PFCS MONITOR control panel as follows: AILERON L OUTBD, L INBD, R INBD and R OUTBD. For a detailed description of the aileron servo solenoid shutoff valves, see 27-11-00.

(7) Spoiler Control Servo Solenoid Shutoff Valves

There are twelve spoiler control servo solenoid shutoff valves, one on each spoiler control servo (Ref. Fig. 10). Energizing the spoiler control servo solenoid shutoff valve shuts down that spoiler servo actuator. The spoiler control servo solenoid shutoff valves are controlled by switchlight on the PFCS monitor control panel as follows: SPOILER L5 & 6, L & R4, L & R1, L & R2, L & R3 and R5 & 6. Spoiler No. 1 control servo solenoid shutoff valves are also energized when the flaps are up or when the No. 1 Spoiler override bungee switch is compressed. For a detailed description of the spoiler control servo solenoid shutoff valve, see 27-61-00.

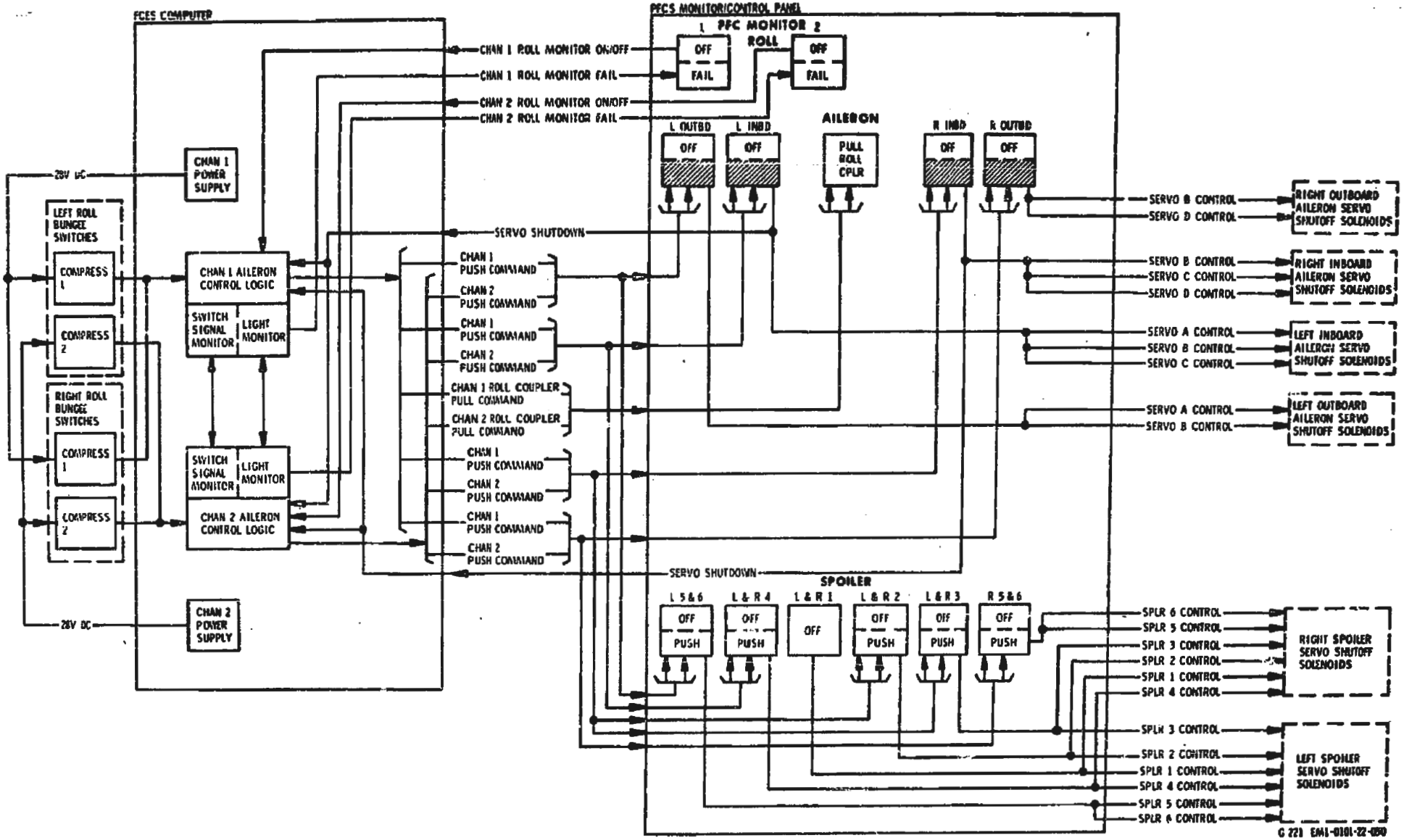
5. Direct Lift Control/Automatic Ground Spoiler (DLC/AGS) System

A. General

The direct lift control (DLC)/automatic ground spoiler (AGS) is an FCES computer function which provides automatic operation of the spoilers to augment the manual approach/land, the automatic approach/land, and the rollout modes. The DLC/AGS function is controlled by inputs from the main landing gear truck and strut switches, the engine power control position switches, the flap lever switches, the autopilot stabilizer servo, the pitch computers, and the trim augmentation computer. The resulting command output signals control a dual DLC servo which, in turn, controls the spoiler servos.

The DLC/AGS system is comprised of the following components (Ref. Fig. 12).

22-10-07 FCES Control Panel



R Roll Axis Monitoring Subsystem Functional Block Diagram
R Figure 11

EFFECTIVITY: ALL

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22-10-11 AFCS/MLG Accessory Unit

22-11-01 Pitch Computer

22-11-05 Autotrim Transducer (Stabilizer Autopilot Control Servo)

22-13-01 Roll Computer

22-17-01 FCES Computer

22-18-01 Trim Augmentation Computer

27-00-01 Surface Position Indicator

27-51-55 Flap Lever Switch

27-61-01 Speed Brake Lever

27-61-06 DLC Servo

32-31-14 Landing Gear Handle

32-31-15 MLG Hydraulic Pressure Switches No. 1 and No. 2 (Landing Gear Control Module)

32-61-08 MLG Truck Unlevel Position Sensor

32-63-01 MLG Air/Ground Safety Sensor

32-63-02 NLG Air/Ground Safety Sensor

33-17-99 AUTO GND SPLRS INOP Light (CAWP)

33-17-99 FLT CONT PANELS Light (CAWP)

33-18-02 Proximity Switch Card Box

33-18-03 Proximity Switch Logic Unit

76-11-00 Throttle Lever Switches

B. Operation

R The direct lift control (DLC) and automatic ground spoiler (AGS) systems (Ref. Fig. 13) of the FCES provide automatic operation of the flight control system spoilers (Ref. 27-61-00) to augment aircraft response during approach and landing. The DLC system improves the pitch axis response of the aircraft in maintaining the desired approach/land flightpath. The AGS system provides automatic deployment of

the spoilers for speedbraking after touchdown and for rejected takeoff.

The DLC and AGS are both two dual-channel systems compatible with the autopilot flight director system dual AUTOLAND configuration. Logic and computations of the DLC/AGS systems 1 and 2 are provided in the two dual-channels (quadruplex logic and computation) of the FCES computer. The two channels are independent of each other and are electrically isolated, except for the nonredundant main and nose landing gear inputs used by both AGS systems. Two spoiler control command signals computed by each DLC/AGS system are applied to the associated channel of the dual electro hydraulic DLC servo (Ref. 27-61-00). Depending on DLC/AGS engagement, either or both servo channels drive the left and right spoilers 1 through 4 in response to the command signals.

The DLC servo operates both as a pilot assist servo and automatic control servo. The speedbrake lever (Ref. 27-61-00) is mechanically linked to the servo for a manual control. The servo is scheduled for DLC and AGS operations primarily as a function of flap lever and engine power control lever positions. Manual speedbrake operation is not scheduled and may be used at any time. During automatic control, the speedbrake lever follows the servo operation. Whenever the automatic operation must be overridden, the speedbrake lever is manually operated.

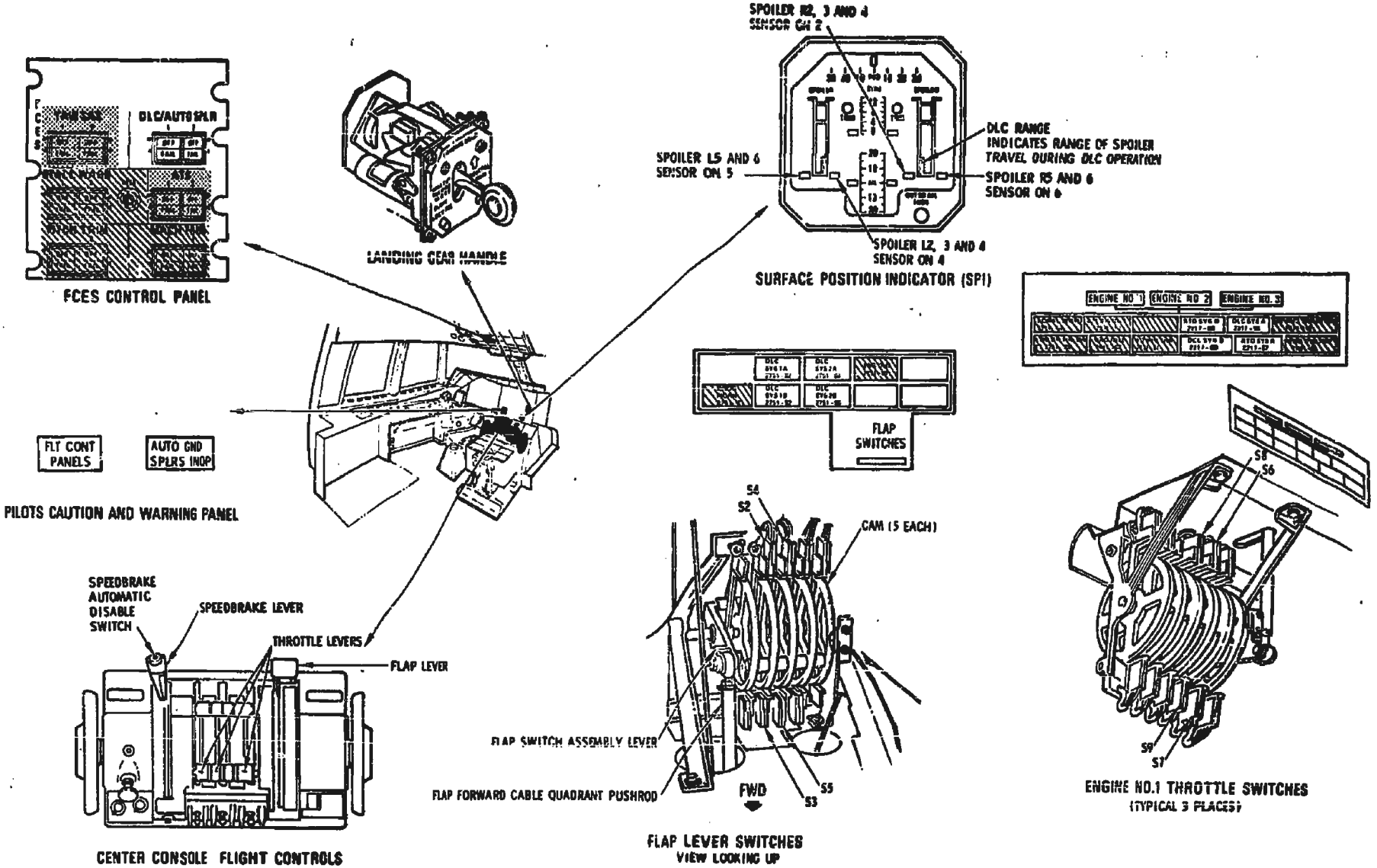
(1) Engagement

The two dual FCES computer DLC/AGS channels are independently engaged through the normally depressed (latched in) DLC/AUTO SPLR switchlights on the FCES control panel. With the switchlights depressed, the DLC-off logic signal to the computer channels is removed. If a switchlight is released (out), the DLC-off logic signal disables the associated channel in the computer.

The FCES computer channel applies 28V dc DLC solenoid engage power to a relay in the FCES control panel. The energized relay applies power to energize solenoid valves in the associated DLC servo.

(2) Direct Lift Control

During manual or automatic approach, the DLC improves the low-speed handling qualities of the aircraft by quickening the aircraft vertical response with reduced pitch attitude excursions. With both DLC control channels engaged, the DLC is armed whenever the flap



R DLC/AGS System Equipment and Location
R Figure 12 (Sheet 1)

EFFECTIVITY: ALL

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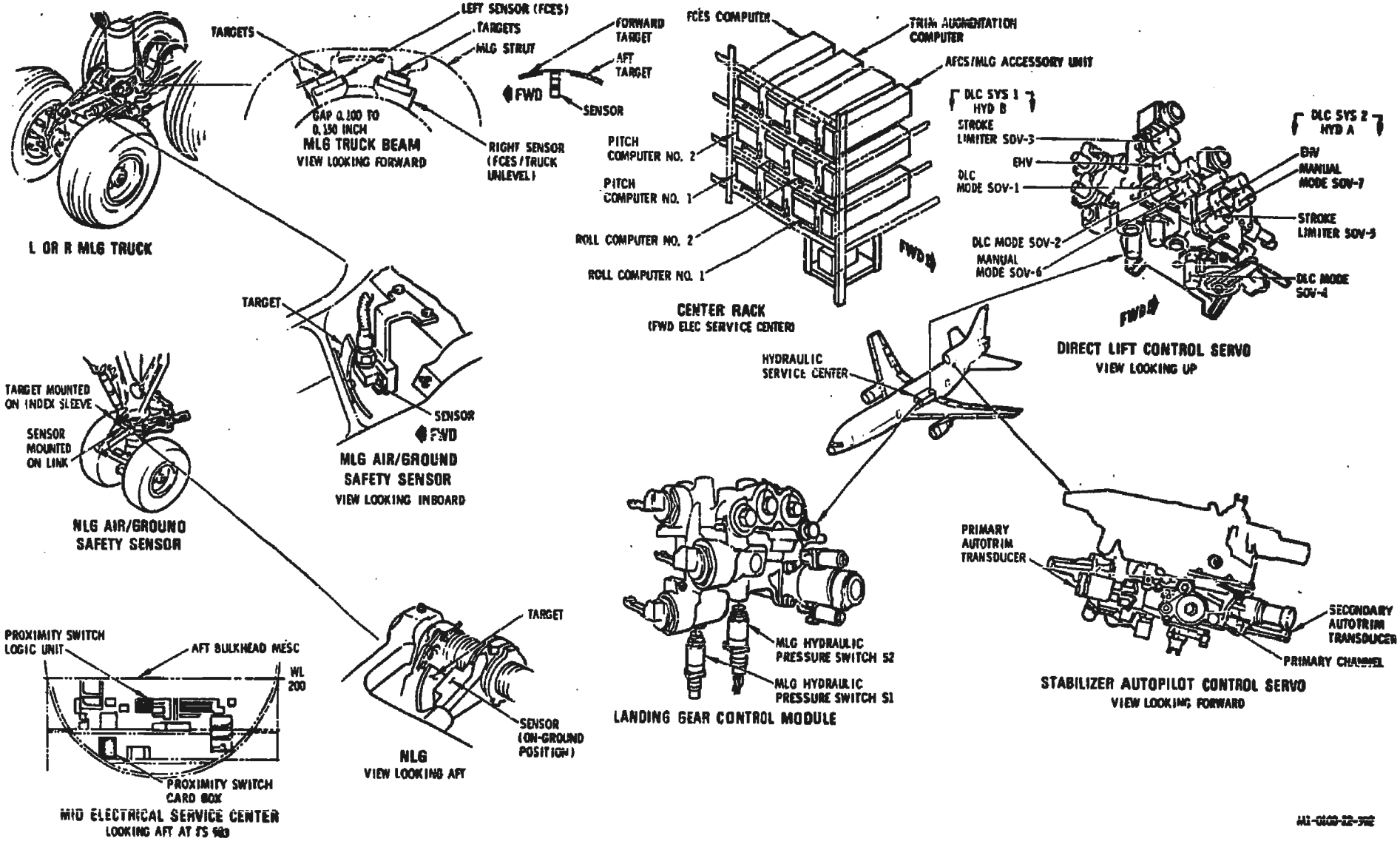

R DLC/AGS System Equipment and Location
R Figure 12 (Sheet 2)

EFFECTIVITY: ALL

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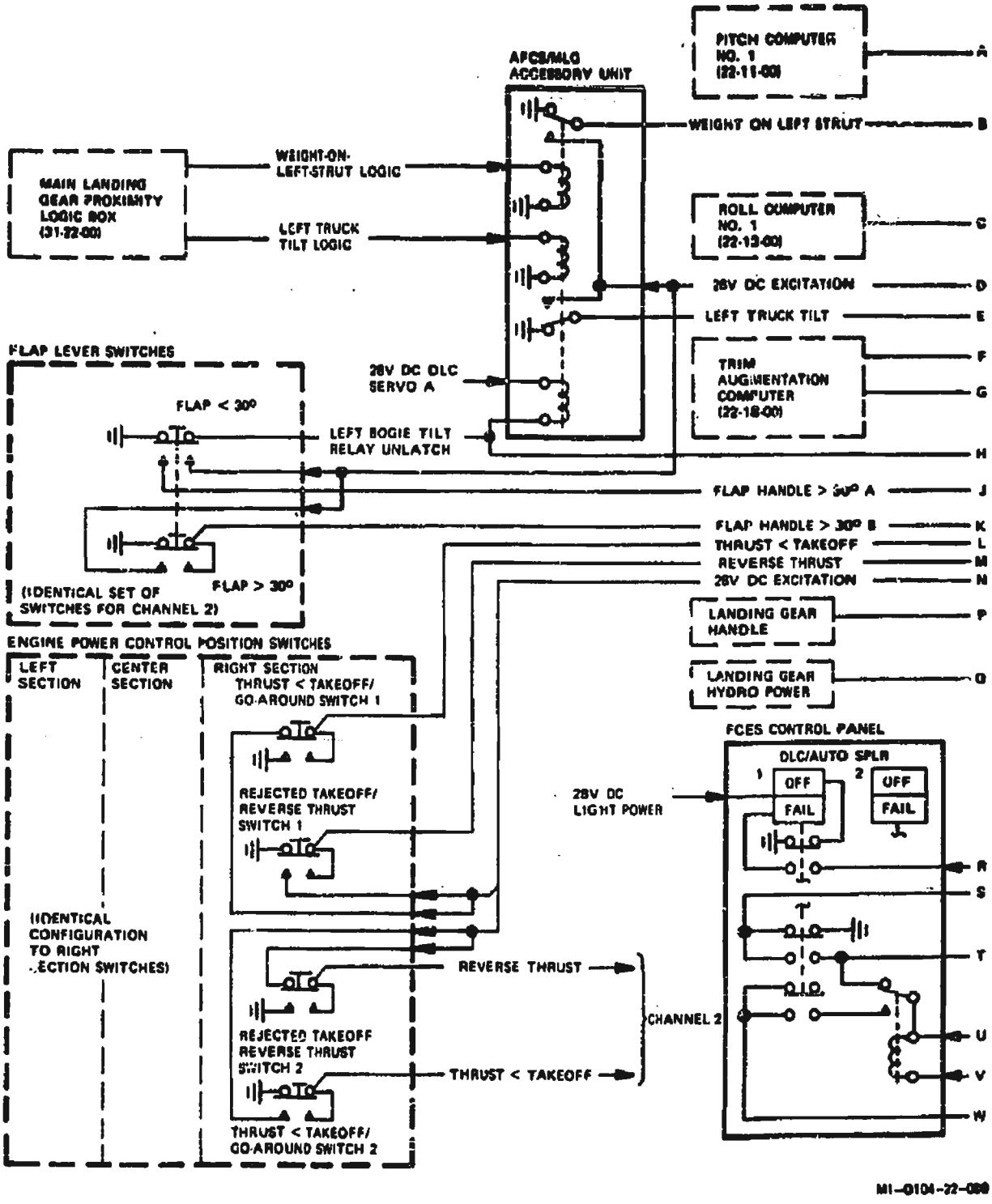
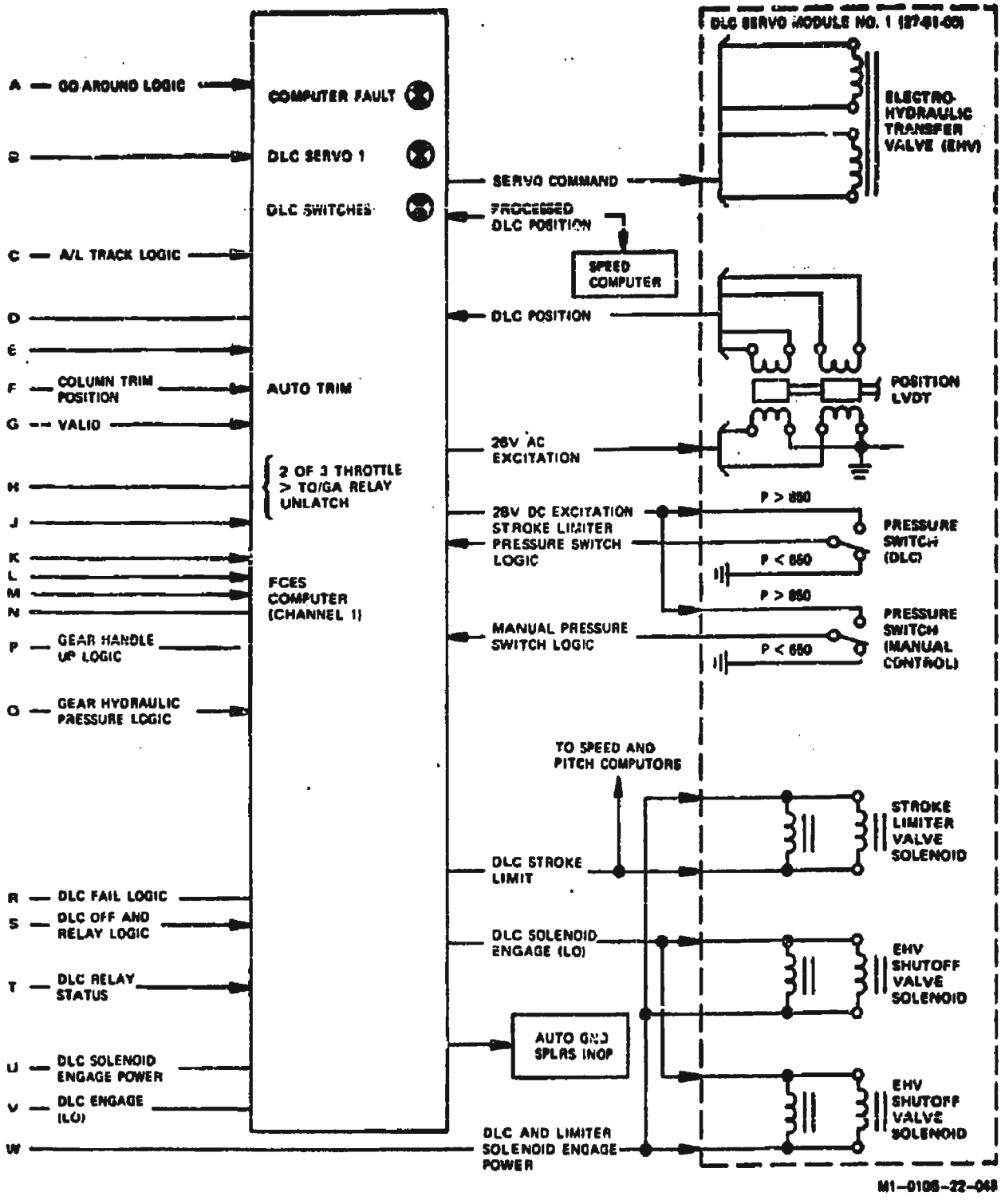


DLC/AGS Functional Block Diagram
Figure 13 (Sheet 1)



DLC/AGS Functional Block Diagram
Figure 13 (Sheet 2)

handle is moved beyond the approach position (30 degrees or more), the engine power control levers (throttles) are set below the takeoff/go-around or AUTOLAND track, the go-around is not initiated, and a stall warning condition is not present.

In manual approach, the autopilot is disengaged or engaged in the basic configuration. In automatic approach, the autopilot must be in the AUTOLAND track mode. When the DLC is armed, the DLC/speedbrake servo is biased to deploy the spoilers to a 7-degree reference point. Thereafter, the spoilers are automatically modulated over the range from 0 to 16 degrees (maximum) in response to the pitch axis command to the stabilizer.

The pitch axis movement of the control column or a command signal from the autopilot positions the stabilizer. The stabilizer displacement from its trim position is sensed by two dual autotrim transducers in the stabilizer autopilot servo package. Each dual transducer sends two identical stabilizer out-of-trim position signals to the associated trim augmentation computer pitch trim channel where the signals are demodulated. The demodulated signals, in addition to being used by the pitch trim system, are fed out of the trim augmentation computer and applied to the associated dual DLC channel of the FCES computer. The signal into each DLC channel is processed through signal shaping network, rate limiter (spoiler deflection of 60 degrees per second), and servo amplifier to produce a command signal to the DLC servo. In process, the DLC position feedback signal is summed into the computation to complete the servo loop.

The two command signals from each DLC channel are applied to the electro-hydraulic transfer valve coils of associated DLC servo channel. The transfer valve controls the hydraulic pressure to the servo actuator in response to the command signal. The transfer valve coils are monitored by a coil current comparator in the associated DLC channel of the FCES computer. The comparator detects an open coil or any incompatible command signals and provides failure indication to the DLC channel monitor.

(3) Automatic Ground Spoiler

The automatic ground spoiler (AGS) system provides automatic deployment of the spoilers after touchdown to shorten the landing roll. Commands are computed as a function of flap extension (flap handle >30°), engine

power control lever position (set below takeoff/go-around position), landing gear truck tilt or strut compression (weight on gear) signals. When all the interlocks are complete, the system sends the full spoiler deflection (60 degrees) command signals to the
R DLC servo. Deployment of the spoilers is limited to 16 degrees (stroke limiter) until both the left and right main landing gear (MLG) trucks tilt or the left and right MLG struts compress. When MLG truck tilt or strut compress logic is satisfied, the DLC stroke limiter constraint on the DLC servo is removed. Spoiler deployment starts for any of the following combinations of truck tilt/strut compression logic:

Left and right MLG truck tilt for low rate of sink landings (Simultaneous MLG Touchdown Landings) - Stroke limiter removed, 60 degrees of spoiler deployment available

R Left MLG truck tilt for left wing low landings - Stroke limiter engaged, 16 degrees of spoiler deployment available

R Right MLG truck tilt for right wing low landings - Stroke limiter engaged, 16 degrees of spoiler deployment available

Left and right MLG strut compression and nose landing gear strut compression for flat landings - Stroke limiter removed, 60 degrees of spoiler deployment available

Inhibiting logic based on the landing gear handle position and availability of MLG hydraulic pressure (system C) is provided in the AGS system to prevent inadvertent premature ground spoiler deployment. The inhibiting logic protects against loss of MLG hydraulic pressure which could cause a MLG truck to tilt and induce an inadvertent airborne AGSB deployment.

In the case of an aborted takeoff, the spoilers are automatically fully deployed (60 degrees) by command signals from the AGS channels generated as a function of left and right MLG strut compressed signals, and thrust reversers (throttle position).

(4) DLC Failure and Disengagement

A failure detected in the input sensors, the computer DLC channel, or the DLC/AGS servo package results in automatic disengagement of the affected channel. The FAIL legend on the associated DLC/AUTO SPLR switchlight

on the FCES control panel come on, and the FLT CONT PANELS caution indicator flashes. The affected channel is turned off by momentarily depressing the switchlight. The FAIL legend goes out and the OFF legend comes on to indicate channel turnoff. The caution indicator goes out when the C/W ANN RESET switch is depressed. The first channel failure does not affect the operation of the second channel.

A second DLC failure causes total disengagement of the automatic DLC and the need to control the spoilers manually. The failure is indicated on the second DLC/AUTO SPLR switchlight on the FCES control panel.

During DLC operation, the following items are monitored in both DLC channels:

- Flap switch
- DLC/AUTO SPLR switchlight
- Computation
- Applied power
- DLC servo
- Manual override control hydraulics
- DLC servo stroke limiter hydraulics
- DLC servo electro hydraulic valve
- DLC servo LVDT (linear variable differential transmitter)
- Stabilizer autotrim transducer

After spoiler deployment, any of the following conditons inhibits normal DLC operation and retracts the spoilers to the 0-degree position:

- Flap handle position is less than 30 degrees
- R Engine power control levers are not set below the takeoff/go-around position and NOT AUTOLAND track
- Go-around is initiated
- A stall warning condition is present

Other conditions which affect normal DLC operation are manual override (using the speedbrake lever) and the DLC channel failures described above.

(5) Automatic Ground Spoiler Failure and Disengagement

In AGS, the items monitored for failure in each channel are the flap switch, the DLC/AUTO SPLR switchlight, the computation, the applied power, and the manual override control hydraulics. A failure in any of the above-specified items causes automatic disengagement of the associated channel causing FAIL legend on associated DLC/AUTO SPLR switchlight to come on.

The left and right main landing gear (MLG) truck tilt and strut compressed inputs and MLG hydraulic pressure (system C) are also monitored in each AGS channel. Both AGS channels are inhibited if a disagreement exists between the left and right MLG logic for any reason for a period greater than 12 seconds or the loss of the MLG hydraulic pressure has occurred with landing gear handle down.

All faults detected which inhibit spoiler deployment or cause disengagement of both AGS channels (manually or automatically), or actions taken to shut down the manual portion of the DLC/AGS servo result in flashing AUTO GND SPLRS INOP caution indicator. The FLT CONT PANELS caution indicator also comes on along with FAIL legend on the DLC/AUTO SPLR switchlights. The AUTO GND SPLRS INOP message indicates that automatic operation will not occur and that manual control of the speedbrake lever is required. Total disengagement of the AGS system causes the spoilers to remain in the positions existing at the time of disengagement. After spoiler deployment, a flap handle movement to less than 30 degrees or engine power control lever above the takeoff/go-around position inhibits normal AGS operation and retracts the spoilers to the 0-degree position. Other conditions which affect normal AGS operation are manual override (using the speedbrake lever) and the AGS channel failures described above.

C. FCES Control Panel

The FCES control panel is located in the pilots overhead panel (Ref. Fig. 12). The panel contains the on/off controls (DLC/AUTO SPLR 1 and 2 pushbutton switches), and FAIL legends for DLC/AGS systems No. 1 and 2. For a detailed description of the FCES control panel, see 22-10-00.

D. AFCS/MLG Accessory Unit

The AFCS/MLG accessory unit is located in the forward electronics service center, center rack (Ref. Fig. 12). The unit provides the DLC/AGS system truck tilt signals, and MLG weight on wheels signal. Removal of the unit during ground testing simulates aircraft airborne. For a detailed description of the unit, see 22-10-00.

E. Pitch Computer

Two pitch computers are located on the center rack in the forward electronics service center (Ref. Fig. 12). The pitch computers provide the DLC/AGS system with go-around logic. For a detailed description of the pitch computer, see 22-11-00.

F. Auto Trim Transducer (Stabilizer Autopilot Servo)

The stabilizer autopilot servo is located in the lower section of the afterbody, between the left and right stabilizer servos. The primary and secondary autotrim transducers, located on the servo, provide each DLC system with control column position (Ref. Fig. 12). For a detailed description of the auto trim transducers, see 22-11-00.

G. Roll Computer

Two roll computers are located on the center rack in the forward electronics service center (Ref. Fig. 12). The roll computers provide the DLC/AGS system with A/L track logic. For a detailed description of the roll computer, see 22-13-00.

H. FCES Computer

R See Paragraph 6.

I. Trim Augmentation Computer

The trim augmentation computer is located in the forward electronics service center, center rack (Ref. Fig. 12). The trim aug computer demodulates control column minus trim signal from the AP pitch servo for use with the DLC system. For a detailed description of the trim aug computer, see 22-18-00.

J. Surface Position Indicator

The surface position indicator (SPI) is located on the pilots center instrument panel (Ref. Fig. 12). The SPI has two indicators that display DLC RANGE during DLC operation.

The position of spoilers 2, 3, 4, 5 and 6 are displayed. For a detailed description of the SPI, see 27-00-00.

K. Flap Lever Switch

The flap lever switches are located immediately aft of the flap forward cable quadrant (Ref. Fig. 12). The switches are cam-actuated through a pushrod connection to the cable quadrant. The switches provide the DLC system with a flap less than 30-degrees signal. For a detailed description of the flap lever switches, see 27-51-00.

L. Speed Brake Lever

The speed brake lever is located on the left side of the center console (Ref. Fig. 12). The top of the speedbrake lever grip contains a momentary alternate-action switch and two lights. Pressing the switch actuates shutoff valves on the DLC servo to shut off hydraulic power to the DLC servo, and turn on the handle lights. Pressing the switch a second time restores normal DLC operation and turns off the handle lights. The speed brake lever position is used to monitor DLC and AGS operation. For a detailed description of the speed brake lever, see 27-61-00.

M. DLC Servo

The DLC servo is located on the rear bulkhead of the hydraulic service center (Ref. Fig. 12). The DLC servo has two modes of operation, manual and electric. In the manual mode, the servo is controlled by the speedbrake lever. In the electric mode, the servo is controlled by the FCES computer. For a detailed description of the DLC servo, see 27-61-00.

N. Landing Gear Handle

The landing gear handle is located on the right side of the pilots center instrument panel (Ref. Fig. 12). Switches in the handle provide the AFCS/MLG accessory unit with either a DOWN (open) or NEUTRAL (28VDC) signal. For a detailed description of the landing gear handle, see 32-31-00.

O. MLG Hyd Press Sw No. 1 and 2 (Landing Gear Control Module)

The MLG hydraulic pressure switches No. 1 and No. 2 are located on the landing gear control module (Ref. Fig. 12). The pressure switches sense Hydraulic C system pressure. For a detailed description of the pressure switches, see 32-31-00.

P. MLG Truck Unlevel Position Sensor

There are four truck unlevel position sensors. Two sensors are mounted on the left MLG truck, and two sensors on the right MLG truck (Ref. Fig. 12). The sensors are off target (between targets) in the truck level position. The sensors provide the proximity card logic box with a truck tilt signal. For a detailed description of the MLG truck unlevel position sensor, see 32-61-00.

Q. MLG Air/Ground Safety Sensor

There are two MLG air/ground safety sensors, one on each MLG. The MLG sensors are mounted on the MLG cylinder, and their target on the upper torque tube (Ref. Fig. 12). The sensors provide the proximity card logic box with an on-ground/airborne signal. For a detailed description of the MLG air/ground safety sensor, see 32-63-00.

R. NLG Air/Ground Safety Sensor

There is one NLG air/ground safety sensor located on the NLG upper torque tube (Ref. Fig. 12). The sensor provides the proximity card logic box with an on-ground/airborne signal. For a detailed description of the NLG air/ground safety sensor, see 32-63-00.

S. AUTO GND SPLRS INOP Indicator Light

The AUTO GND SPLRS INOP indicator light is located on the pilots center instrument panel, caution and warning panel (Ref. Fig. 12). The indicator comes on when hydraulic C pressure is off, or both DLC/AGS switch lights are off, or one DLC/AGS switch light is off and the DLC/AGS system on FAILS or the associated hydraulic system is off.

T. FLT CONT PANELS Indicator Light

The FLT CONT PANELS indicator light is located on the pilots center instrument panel, caution and warning panel (Ref. Fig. 12). The indicator comes on when either or both DLC/AGS switchlights on the FCES control panel comes on.

U. Proximity Switch Card Box

The proximity switch card box is located in the mid electrical service center, zone 137 (Ref. Fig. 12). The proximity switch card box senses when a target is brought into proximity with the sensing surface and provides the following outputs:

SENSOR	SENSOR POSITION & BOX OUTPUT
NLG Air/Ground	ON target (on-ground) - Logic 0 (gnd)

SENSOR	SENSOR POSITION & BOX OUTPUT
Safety Sensor	OFF target (airborne) - Logic 1 (28 VDC)
MLG Air/Ground Safety Sensors	ON target (on-ground) - Logic 0 (0 VDC) OFF target (airborne) - Logic 1 (16 VDC)
MLG Truck Unlevel Position Sensors	ON target (tilt) - Logic 1 (16 VDC) OFF target (level) - Logic 0 (0 VDC)

For a detailed description of the proximity switch card box, see 31-22-00.

V. Proximity Switch Logic Unit

The proximity switch logic unit is located in the mid electrical service center, zone 137 (Ref. Fig. 12). The unit inverts the MLG on ground signals from ground (logic 0) to 28V dc (logic 1). The 28V dc on ground signals energize air/ground relays K1, K2, K3 and K4 in the AFCS/MLG accessory unit. The unit also converts the MLG truck tilt signals from 16V dc to 28V dc (logic 1). The 28V dc tilt signal latches truck tilt relays K5, K6, K9 and K11 in the AFCS/MLG accessory unit. The truck tilt relays are reset when the flaps are positioned less than 30 degrees, or two of three throttle levers are set to the higher than TO/GA position. For a detailed description of the proximity switch logic unit, see 31-22-00.

W. Throttle Lever Switches

The engine power control position switches (Ref. Fig. 12) are cam-operated microswitches which provide signals representing engine thrust settings. Each of the three engine power control sections contains four switches (for a total of 12) which are associated with the flight control electronics system. The switches are connected to the direct lift control (DLC)/automatic ground spoiler (AGS) circuits as follows:

Three thrust-less-than-takeoff/go-around switches to DLC channel 1

Three thrust-less-than-takeoff/go-around switches to DLC channel 2

Three rejected takeoff/reverse thrust switches to AGS channel 1

Three rejected takeoff/reverse thrust switches to AGS channel 2

The switch position signal to the DLC and AGS channels is part of the logic necessary for channel engagement/disengagement.

Each thrust-less-than-takeoff/go-around switch is activated by a cam as the associated power control lever is positioned to less than the takeoff/go-around thrust position. When any two switches are activated, the associated DLC channel receives two thrust-less-than-takeoff/go-around signals which enable DLC operation. The signals are used throughout DLC operation and into the AGS operation at touchdown.

Each rejected takeoff/reverse thrust switch is activated by a cam as the associated engine power control lever is positioned to the reverse thrust position. When any two switches are activated, the associated AGS channel receives two reverse thrust signals which enable AGS operation. (DLC
R servo stroke limit).

R Loss of accelerometer valid or Mach valid to a channel will
R prevent it from being engaged and will disengage it if
R engaged.

6. FCES Computer

A. Description

The flight control electronics system (FCES) computer is contained in a 3/4 ATR case. The computer is located in the forward electronics service center, center rack (Ref. Fig. 2). The front panel contains a carrying handle, a series of fault isolation monitor annunciators, and an annunciator reset switch. Mounting hooks are provided to secure the case to a mounting rack. Three dual electrical connectors are provided on the rear of the case for system interface.

The case houses a chassis on which the modules are either mounted or plugged in. The plug-in module boards are inserted into a side plane interconnect from the right side (with respect to case front) of the chassis. Two power converter assemblies are mounted on the rear of the chassis.

The computer contains four dual-channel functions and one single-channel function implemented in 21 plug-in module boards. One channel comprising 10 boards occupies the rear section of the computer. The second channel, consisting of an identical set of boards, is in the front section of the

computer. The two channels are separated by the remaining board which is used for fault isolation monitoring.

7. PFCS Monitor/Control Panel

A. Description

The primary flight control system (PFCS) monitor/control panel (Ref. Fig. 14) contains indicators and switchlights to monitor and control the PFCS control paths. The panel is part of the PFCS monitoring system which detects jam, open, and other failures in the PFCS control paths. The panel also is part of the PFCS hydraulic power control system which allows pilot control of the hydraulic power applied to the primary flight control surface servo actuators. The panel provides the following functions:

- Annunciation of corrective action commands when a failure is detected in the stabilizer, the aileron, or the control paths. The panel also provides switches to disconnect the hydraulic power applied to the control surface servo actuators.

- Corrective action commands to disconnect the pitch and roll mechanical couplers to relieve jams and failures in the stabilizer and aileron control path.

- Annunciation of failures in the PFCS monitoring system and subsequent turn-off of the affected system.

- Total disconnection of hydraulic power to the rudder servos.

- Selection of a single hydraulic power source for each control surface servo actuator for ground testing.

The PFCS monitor/control panel contains 19 pushbutton switchlights and 3 annunciator indicators grouped in the sections of the panel identified as PFCS MONITOR, RUDDER, STABILIZER, AILERON, and SPOILER. All switchlights and annunciator indicator legends remain dark (not lighted) when the PFCS and the PFCS monitoring system are operating properly. A legend or a combination of legends come on when a failure is detected in the corresponding primary flight control path, and when a designated or a select primary flight control servo hydraulic power is turned off. The switchlight legends and the annunciator indicators when on are as follows:

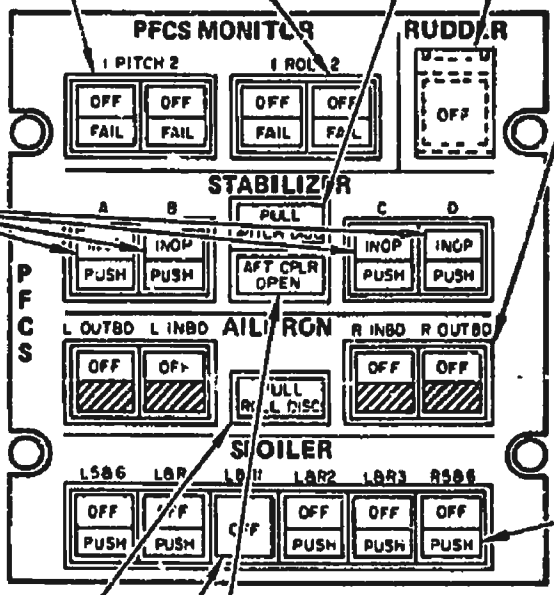
- STABILIZER SWITCHLIGHTS: PUSH legend is amber and INOP legend is white

PITCH & ROLL MONITOR SWITCHES
MONITORS RESPECTIVE CONTROL SYSTEM FOR JAM. TURNS ON PROPER PUSH LIGHTS TO ALLEVIATE PROBLEM
IN
NORMAL POSITION WITH NO LIGHTS ILLUMINATED. POWER TO MONITOR IS TURNED ON AND FAIL LIGHT IS ARMED. FAIL IS ILLUMINATED TO INDICATE MONITOR FAILURE
OUT
OFF IS ILLUMINATED TO INDICATE SWITCH POSITION. POWER TO MONITOR IS TURNED OFF AND FAIL LIGHT IS DISARMED

STABILIZER CONTROL SWITCHES
IN
PUSH (A & B OR C & D) IS ILLUMINATED WHEN A PITCH CONTROL PATH MECHANICAL JAM HAS OCCURRED AND REQUIRES PILOT ACTION.

INOP IS ILLUMINATED WHENEVER HYDRAULIC POWER IS REMOVED FOR ANY REASON
OUT
INOP IS ILLUMINATED, ACTUATOR IS BYPASSED, AND PUSH LIGHT IS NOT ARMED. WHEN BOTH A & B OR C & D HAVE BEEN SHUT DOWN, AFT COUPLER WILL OPEN

PULL ROLL DISCONNECT LIGHT
EITHER L OR R ROLL LOADPATH IS JAMMED



PULL PITCH DISCONNECT LIGHT
ILLUMINATED WHEN AFT COUPLER HAS OPENED

RUDDER OFF SWITCH
IN
NORMAL POSITION
OUT
BY-PASSES ALL HYDRAULIC ACTUATORS AND RUDDER WILL TRAIL
OFF
INDICATES SWITCH POSITION

AILERON CONTROL SWITCHES
IN
NORMAL POSITION. SERVOS ARE POWERED
CROSS HATCH
JAM IN RESPECTIVE LOAD PATH. SPOILER PUSH LIGHTS AND PULL ROLL DISCONNECT WILL BE ON
OUT
OFF IS LIGHTED. INDICATES SWITCH POSITION ONLY

SPOILER CONTROL SWITCHES
IN
NORMAL POSITION. SERVOS ARE POWERED
PUSH
RESPECTIVE LOAD PATH IS JAMMED
OUT
OFF IS LIGHTED. INDICATES SWITCH POSITION ONLY. WHEN PUSH IS ILLUMINATED ONLY IN SPOILER SWITCHES L5 & 6 AND R5 & 6, RESPECTIVE SPOILERS ARE OPERATING IN WRONG MODE FOR FLAP POSITION

AFT COUPLER OPEN LIGHT
AUTOMATIC SEPARATION OF AFT COUPLER HAS TAKEN PLACE. MAY BE RECLOSED BY RELATCHING SWITCHES

SPOILER L&R1 SWITCH
IN
NORMAL POSITION
OUT
SHUTS DOWN NO. 1 SPOILERS. OFF INDICATES SWITCH POSITION

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R PFCS MONITOR Control Panel
R Figure 14

- AILERON switchlights: striped annunciation (bottom half) is amber and OFF legend is white

- SPOILER switchlights: PUSH legend is amber and OFF legend is white

- RUDDER switchlight: opaque white OFF legend is illuminated by red background

- PFCS MONITOR switchlights: FAIL legend is amber and OFF legend is white

- The following legends are amber when illuminated:

  PULL PITCH DISC

  AFT CPLR OPEN

  PULL ROLL DISC

The PFCS monitor/control panel is internally edge-lighted to highlight the panel designators. Three electrical connectors are provided on the rear of the panel.

B. Operation

When a jam, open, or other failure is detected in the stabilizer control path, the PUSH legend on the applicable STABILIZER switchlights comes on. By acknowledging the push commands, the PUSH legend on the affected switchlights goes out and the INOP legend comes on to indicate that hydraulic power is removed from the stabilizer power servo associated with the affected control path. At the same time, a signal is generated by a logic unit to turn on the AFT CPLR OPEN and PULL PITCH DISC indicators. The AFT CPLR OPEN indicates that the aft pitch coupler is decoupled. The PULL PITCH DISC indication urges the pilot to disconnect the forward pitch coupler for a complete detachment of the left and right stabilizer control paths.

When a jam is detected in the aileron control path, the striped half of the applicable AILERON switchlights and the PUSH legend on the applicable SPOILER switchlights come on. At the same time, the PULL ROLL DISC indicator comes on, urging the pilot to disconnect the forward roll coupler. By depressing the SPOILER switchlights as commanded, the PUSH legend is replaced by the OFF legend to indicate that hydraulic power is removed from the associated spoiler control servo. The illumination of the striped half of the AILERON switchlights gives the pilot discretion to shut down the associated aileron control servos.

The PFCS MONITOR PITCH and ROLL switchlights monitor the pitch and roll control path monitoring system. A failure in the monitoring system causes the corresponding FAIL legend to come on. When the switchlight is depressed, the affected monitor is disconnected and the OFF legend comes on.

The RUDDER switchlight controls the total rudder servo hydraulic power. When a condition requires total disconnection of the rudder hydraulic power, the guarded switchlight is depressed; the OFF legend comes on to indicate that hydraulic power to the rudder has been turned off.

R # FLIGHT CONTROL ELECTRONICS SYSTEM - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting Flight Control Electronics System (FCES) faults are included in this section of the manual. An FCES malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Referenced Procedures

R	21-25-00	Electronic and Electrical Service Centers Exhaust System - Adjustment and Test
R	24-00-00	Electrical Power - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices

R 3. Fault Isolation/Identification

R The Flight Control Electronics System (FCES) is provided with Fault Isolation Monitor (FIM) for continuous in-flight system fault monitoring, isolation, and identification. The FIM consists of channel input signal comparators, output signal comparators, and in-line monitors incorporated in the FCES computer. Upon detection and isolation of a failure, the FIM circuit generates a signal that sets one of the latching-type annunciators provided on the FCES computer. The following are the FIM annunciators on the FCES computer and their respective causes for indicating a failure:

R COMPUTER FAULT - Fault isolated to the FCES computer.

R ANGLE OF ATTACK 1 and ANGLE OF ATTACK 2 - Fault Isolated to the respective angle-of-attack sensor.

DLC SERVO 1 and DLC SERVO 2 - Mechanical, hydraulic, or electrical fault in the DLC servo channel 1 and 2, respectively.

DLC SWITCHES - Incompatible switch logic input signals from the throttle position switches or DLC control switches to the two FCES channels.

AIR DATA INPUTS - Excessive difference between the two central air data computer Mach inputs to the Mach trim and feel channels.

CONTROL WHEEL 1 and CONTROL WHEEL 2 - Fault isolated to the Captains and First Officers control wheels, respectively.

ELEC FEEL & TRIM MECH - Fault isolated to the electrical feel/trim mechanism (including pitch trim motors, Mach trim motors, and Mach feel schedule motors).

Once set, the FCES COMPUTER FAULT FIM annunciator remains set. All FIM annunciators on the FCES computer are reset by depressing the RESET switch on the FCES computer.

Table 101 lists all FCES computer system schematics.

Flight Control Electronic System Fault Isolation Schematic and Diagram List
Table 101

R R R FIGURE NUMBER	TITLE
R 101	Component Location Index
R 102 R (Sheets 1 thru 5)	Component Locator Diagrams
SCHEM 1	FCES Computer Block Diagram
SCHEM 2	FCES Computer Secondary Power Distribution
SCHEM 3	Stall Warning
SCHEM 4	Altitude Alert
SCHEM 5	Stabilizer Hydraulics and Pitch Aft Coupler Control
SCHEM 6	Stabilizer Annunciator Logic

Flight Control Electronic System Fault Isolation Schematic and Diagram List (Cont)
Table 101

R	FIGURE NUMBER	TITLE
R	SCHEM 7	Aileron Hydraulics Control
R	SCHEM 8	Spoiler Hydraulics Control
R	SCHEM 9	Aileron and Spoiler Annunciator Logic
R	SCHEM 10	DLC/AGSB Analog Signal Flow
R	SCHEM 11	DLC/AGSB System No. 1 Logic
R	SCHEM 12	DLC/AGSB System No. 2 Logic
R	SCHEM 13	FCES FIM

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCESSORY UNIT - AFCS/MLG	1	FESC, CTR RACK/112AB	22-10-11
CABLE BREAK DETECTOR - PITCH	2	FWD CARGO CEILING/128NR, 128NL	87-41-41
COMPUTER - FLIGHT CONTROL ELECTRONICS SYSTEM	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER - PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER - ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER - SPEED CONTROL	1	FESC, CTR RACK/112AB	22-31-07
COMPUTER - TRIM AUGMENTATION	1	FESC, CTR RACK/112AB	22-18-01
CONTROL BOX - INDICATOR LIGHTS, CARD 1A2	1	FESC, AFT OF ELEC TRACK/112AB	33-17-04
COUPLER, AFT PITCH	1	AFTERBODY/316BB	27-41-17
INDICATOR - BAROMETRIC ALTITUDE	2	FLT STA/CAPT AND F/O INSTR PNL	34-14-03
LIMITER - ROLL TORQUE	1	FESC/112AB	27-11-05
PANEL - ALTITUDE SELECT	1	FLT STA/GLARESHIELD PNL	22-00-03
PANEL - FCES CONTROL	1	FLT STA, PILOTS OVHD PNL	22-10-07
PANEL - PFCS CONTROL	1	FLT STA PILOTS OVHD PNL	22-17-02
SENSOR - ANGLE-OF-ATTACK	2	EXT, L&R/FS 215	22-31-06
SERVO - OLC	1	HYDRAULIC SERVICE CENTER	27-61-06
SERVO - SPOILER CONTROL	2	AFTERBODY/317AB, 317CB	27-41-20
SERVO - STABILIZER AUTOPILOT CONTROL	1	AFTERBODY/316DB	22-11-05
SHAKER - STICK	2	FESC/112AB	22-17-16
SWITCH - PITCH BUNGEE	2	FESC/112AB, 211CB	27-41-06
SWITCH - FLAP CONTROL	2	FESC, FWD RIGHT OVHD/112AB	27-51-55
SWITCH - MLG HYDRAULIC PRESSURE	2	MCS/147AB	32-31-15
SWITCHES - THROTTLE	3	FESC/112AB	76-11-06
SWITCHBOX - FLAP PDU	2	MSC, AFT LEFT CLG ON FLAP PDU/147AB	27-51-12
SWITCHBOX - SLAT POWER DRIVE UNIT	2	WING BUTT LEFT/511BT	27-81-08
UNIT - AURAL WARNING	1	FLT STA, UNDER FE/SO CSL	31-22-03

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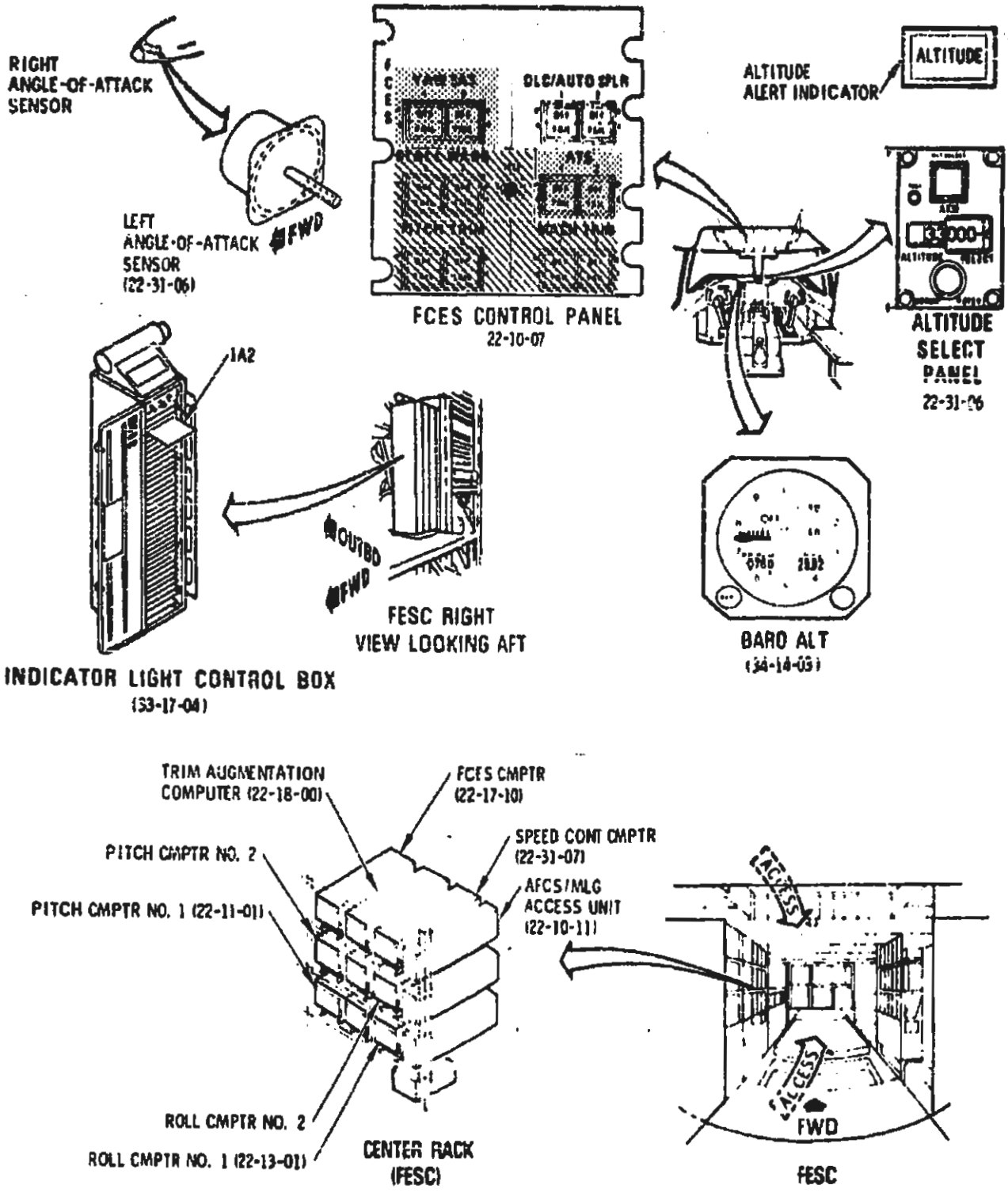
R Component Location Index
R Figure 101

EFFECTIVITY: ALL

001B



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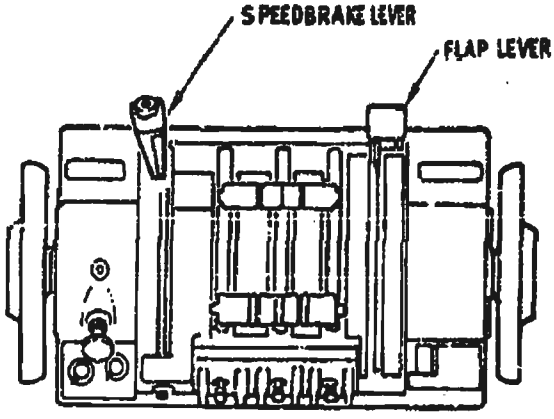
R
R

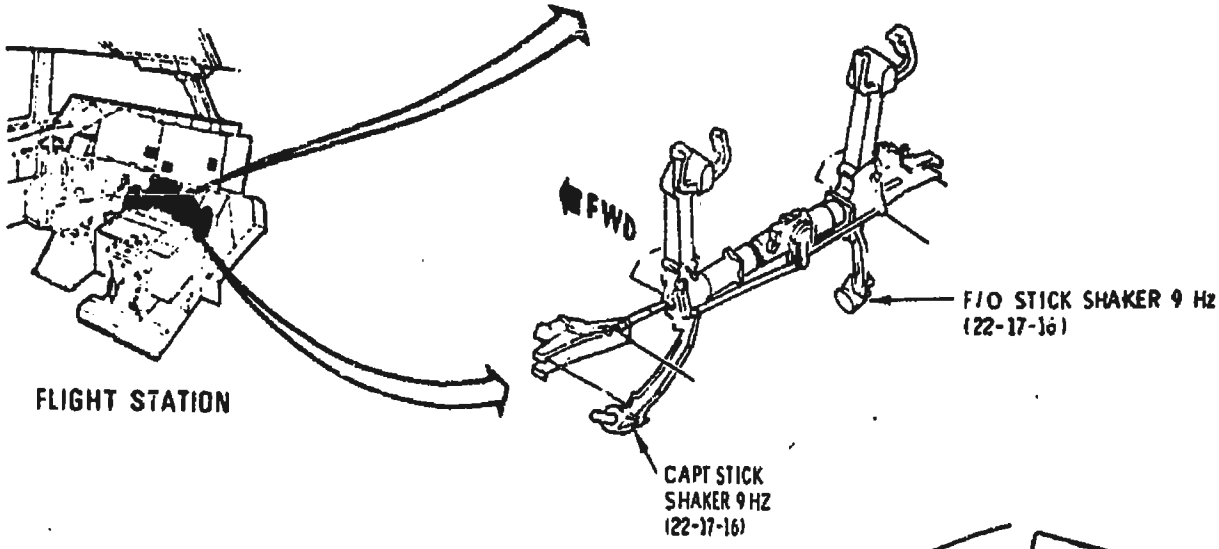
Component Location Diagram
Figure 102 (Sheet 1)

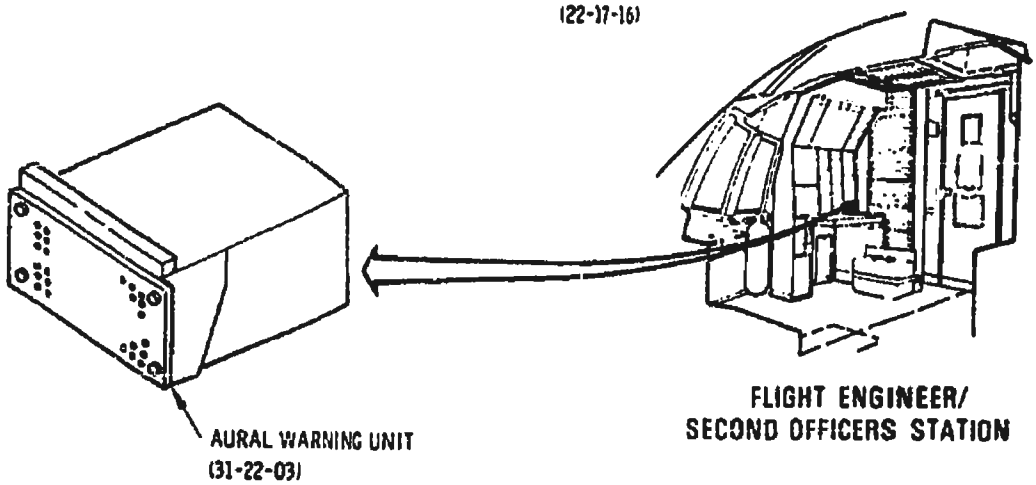
EFFECTIVITY: ALL

0018



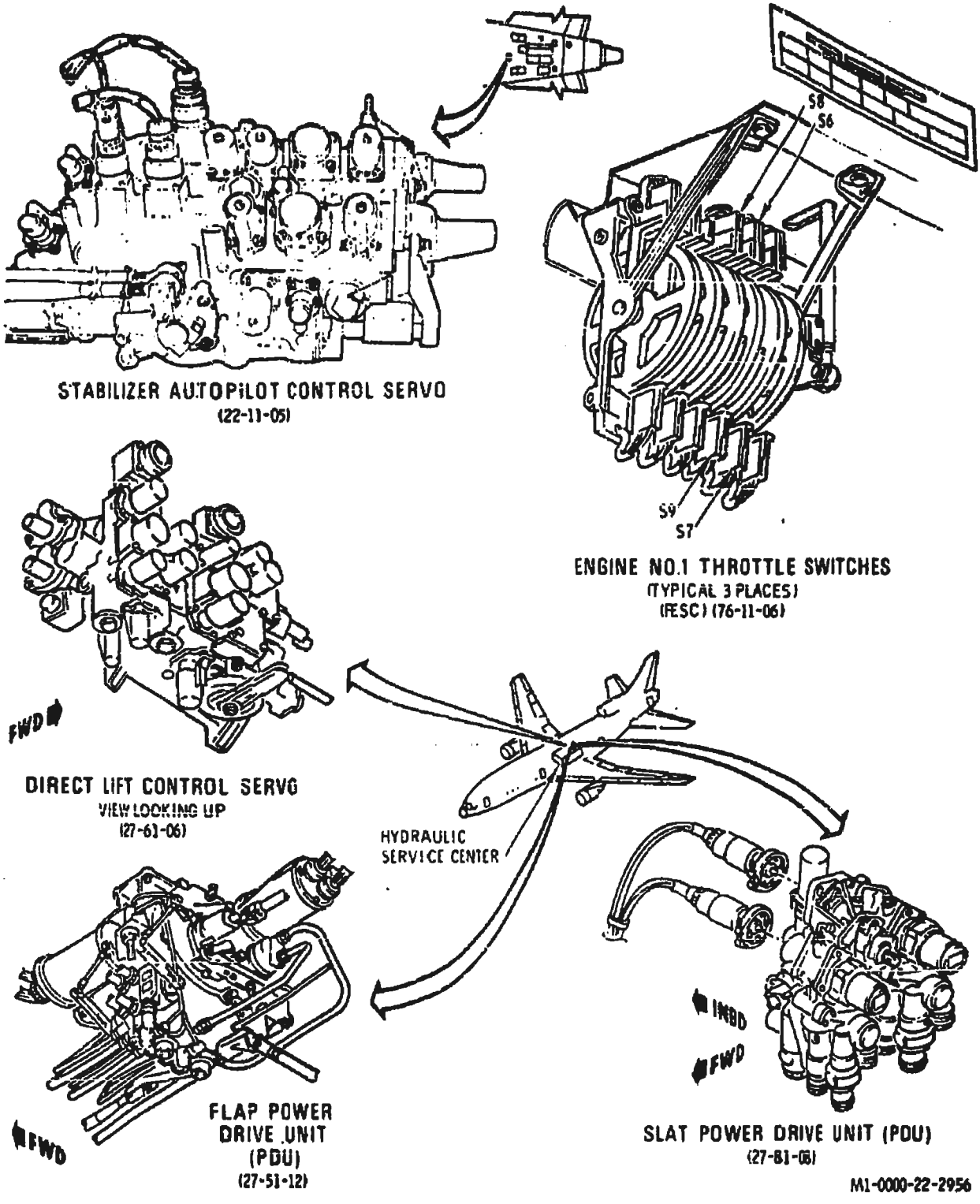
CENTER CONSOLE FLIGHT CONTROLS





M1-0000-22-2955

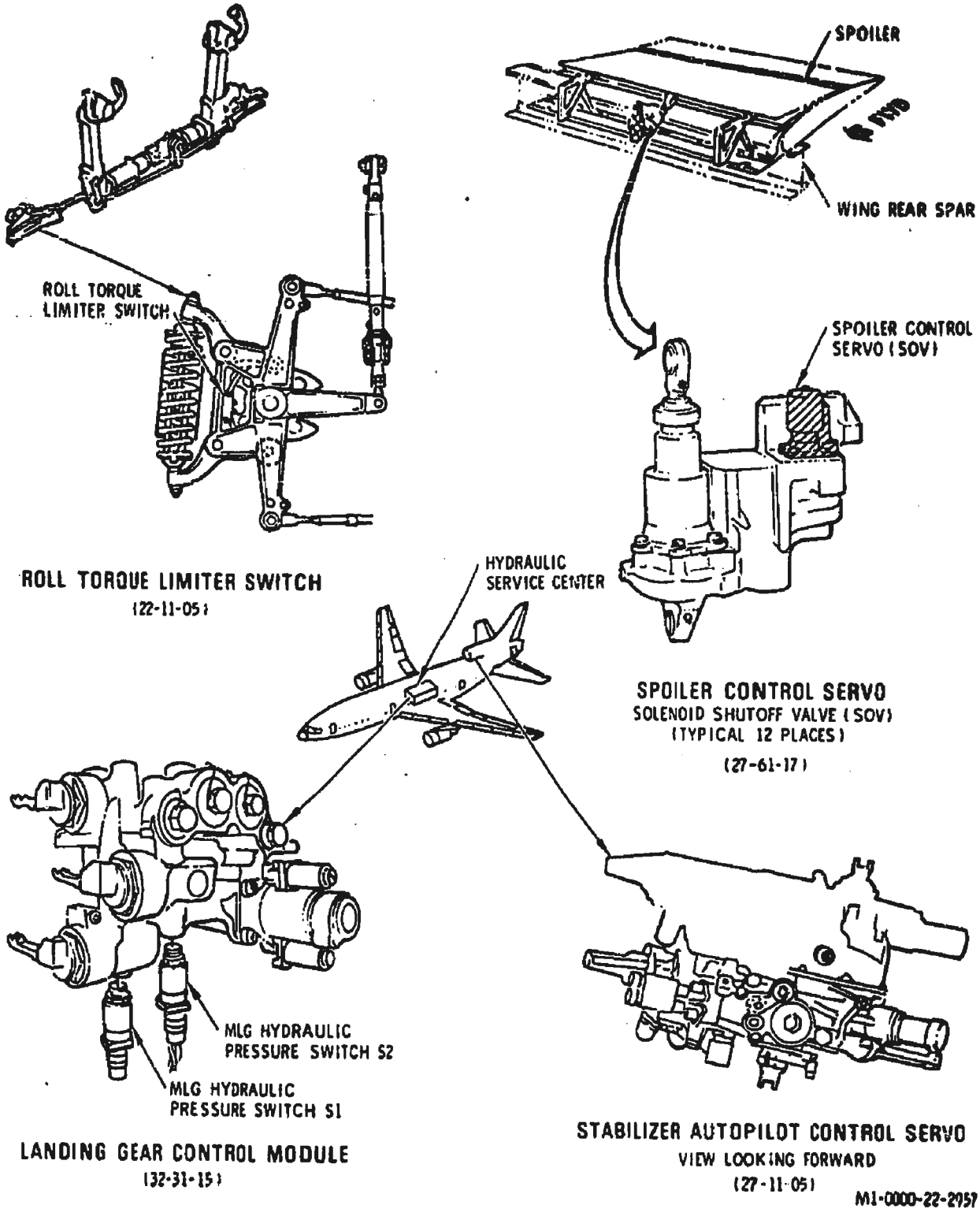
R Component Locator Diagram
R Figure 102 (Sheet 2)



R Component Locator Diagram
R Figure 102 (Sheet 3)

EFFECTIVITY: ALL

001B



ROLL TORQUE LIMITER SWITCH
(22-11-05)

SPOILER CONTROL SERVO
SOLENOID SHUTOFF VALVE (SOV)
(TYPICAL 12 PLACES)
(27-61-17)

LANDING GEAR CONTROL MODULE
(32-31-15)

STABILIZER AUTOPILOT CONTROL SERVO
VIEW LOOKING FORWARD
(27-11-05)

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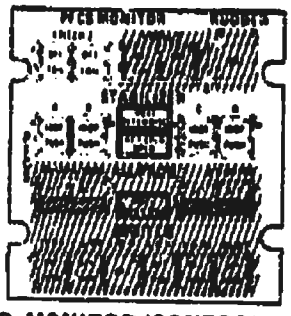
R
R

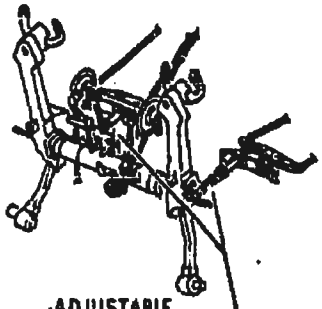
Component Locator Diagram
Figure 102 (Sheet 4)

EFFECTIVITY: ALL

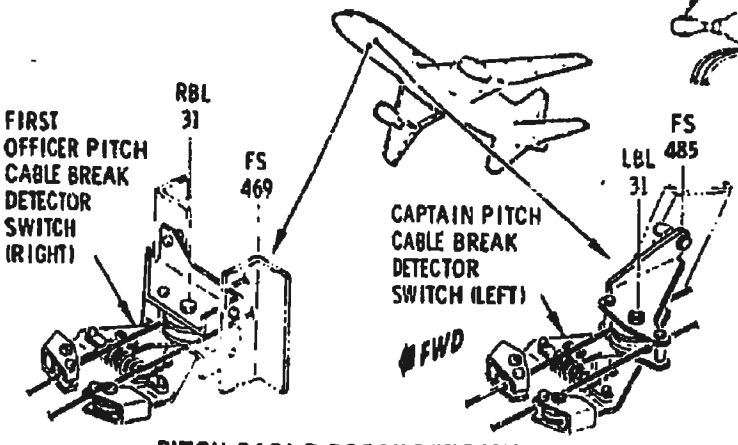
001B



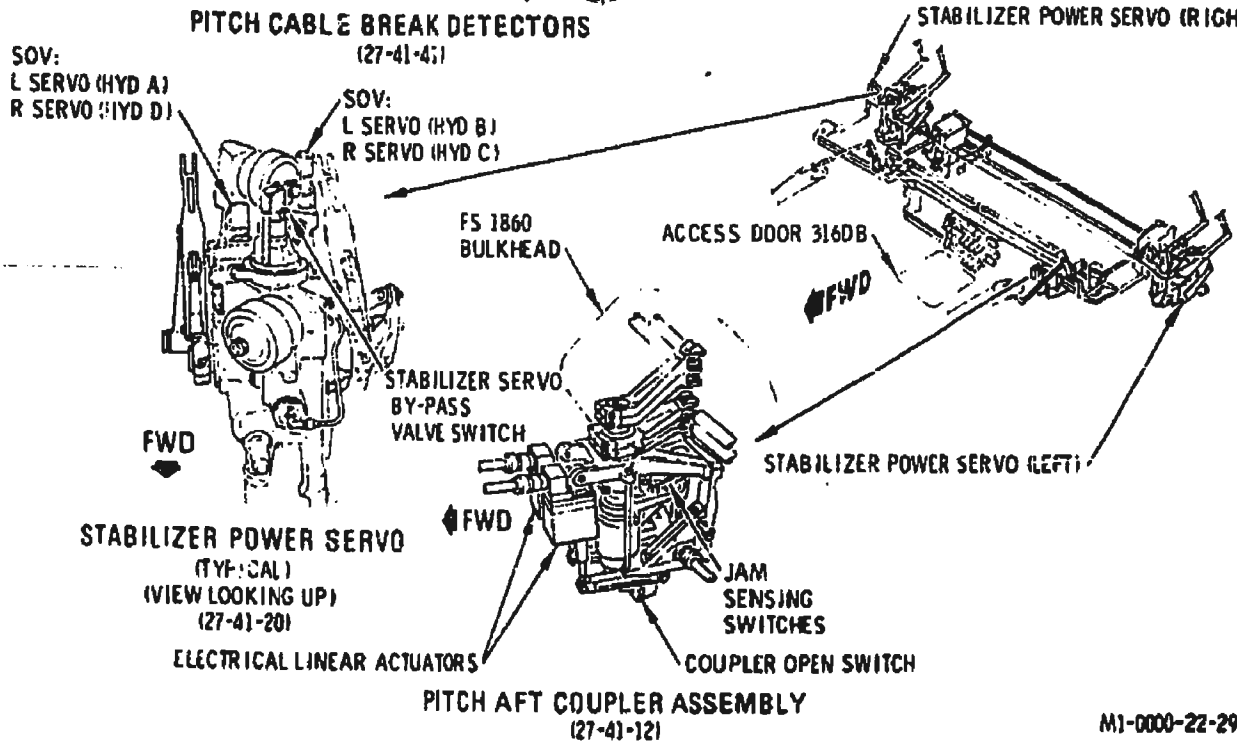
PFCS MONITOR/CONTROL PANEL
(PILOTS OVHD PANEL)
(22-17-02)



PITCH BUNGEE SWITCH
(27-41-06)



PITCH CABLE BREAK DETECTORS
(27-41-47)



PITCH AFT COUPLER ASSEMBLY
(27-41-12)

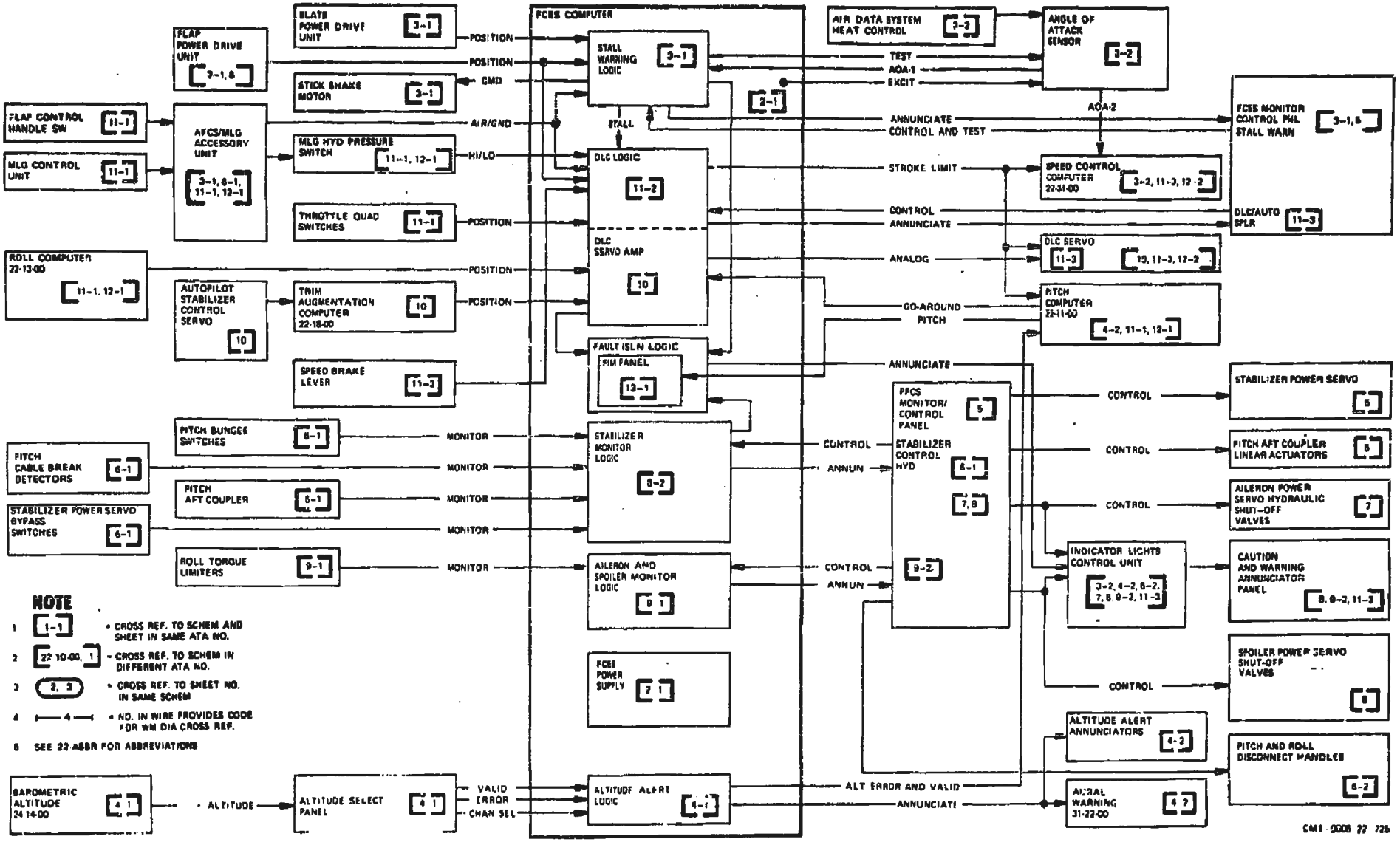
M1-0000-22-2958

R
R

Component Locator Diagram
Figure 102 (Sheet 5)

EFFECTIVITY: ALL

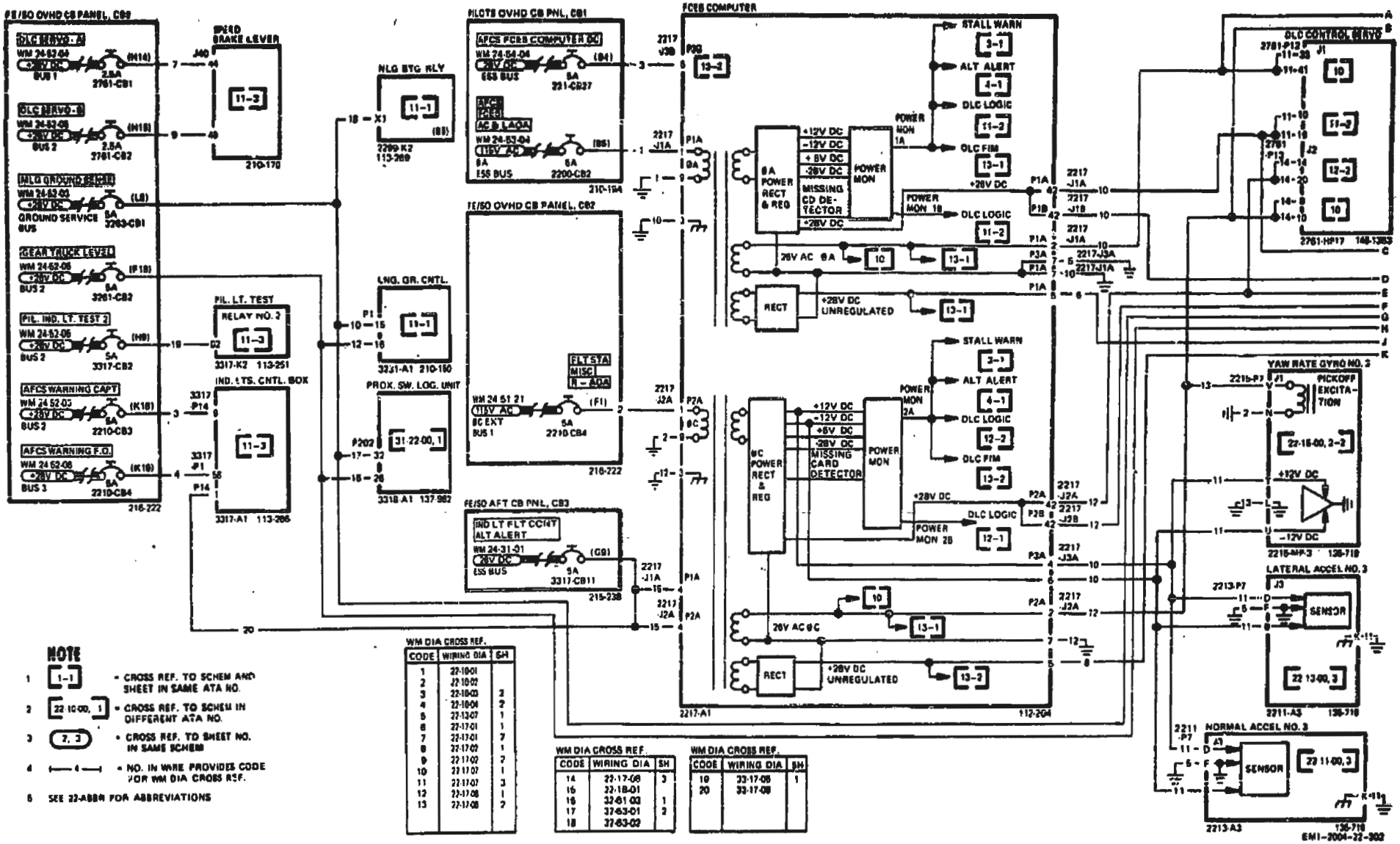
001B



R FCES Computer Block Diagram
R SCHEM 1

EFFECTIVITY: ALL

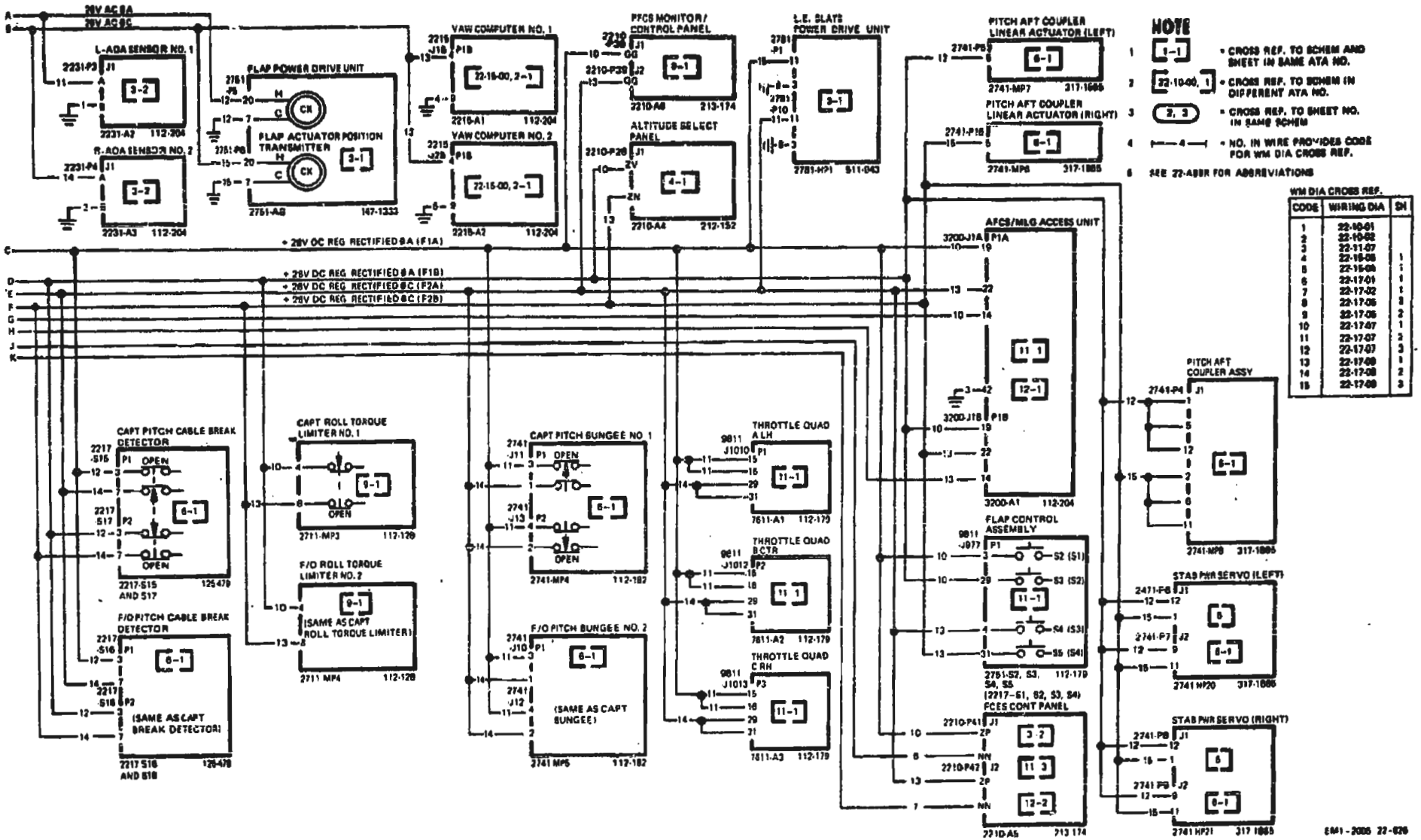
001B


FE/SO OVHD CB PANEL, CB2
SLC SERVO A
SLC SERVO B
NLG GROUND RESET
GEAR TRUCK LEVER
PIL. IND. LT. TEST 2
AFCS WARNING CAPT
AFCS WARNING F.O.
SPEED BRAKE LEVER
NLG STG. RLY
PIL. LT. TEST
RELAY NO. 2
IND. LTS. CNTL. BOX
LNG. GR. CNTL.
PROX. SW. LOG. UNIT
PILOTS OVHD CB PNL, CB1
AFCS FCES COMPUTER DC
AFCS FCES COMPUTER AC
FE/SO OVHD CB PANEL, CB2
FE/SO AFT CB PNL, CB3
IND LT FLT CONT ALT ALERT
FCES COMPUTER
8A POWER RECT & REG
8C POWER RECT & REG
MISSING CD DETECTOR
MISSING CARD DETECTOR
POWER MON
STALL WARN
ALT ALERT
DLC LOGIC
DLC FIM
RECT
+28V DC UNREGULATED
26V AC 8A
26V AC 8C
YAW RATE GYRO NO. 2
PICKOFF EXCITATION
LATERAL ACCEL NO. 3
NORMAL ACCEL NO. 3
SENSOR
NOTE
1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (7, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-19-01
2 | 22-19-02
3 | 22-19-03 | 2
4 | 22-19-04 | 2
5 | 22-13-07 | 1
6 | 22-17-01 | 1
7 | 22-17-01 | 2
8 | 22-17-02 | 1
9 | 22-17-02 | 2
10 | 22-17-07 | 1
11 | 22-17-07 | 3
12 | 22-17-08 | 1
13 | 22-17-08 | 2
WM DIA CROSS REF.
CODE | WIRING DIA | SH
14 | 22-17-08 | 3
15 | 22-18-01
16 | 32-61-03 | 1
17 | 32-63-01 | 2
18 | 32-63-02
WM DIA CROSS REF.
CODE | WIRING DIA | SH
19 | 33-17-08 | 1
20 | 33-17-08

R FCES Computer Secondary Power Distribution
R SCHEM 2 (Sheet 1)

EFFECTIVITY: ALL

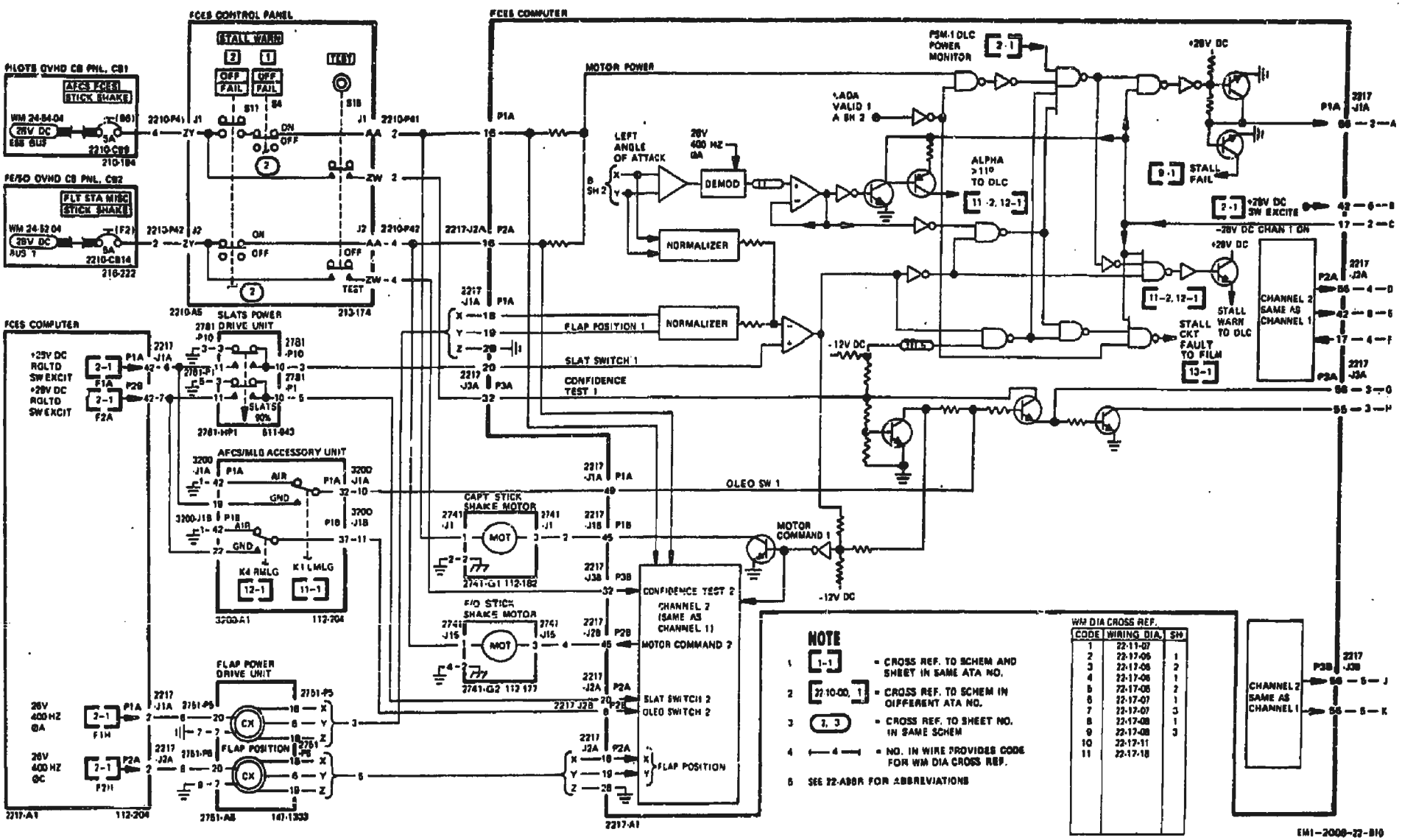
001B


28V AC BA
28V AC BC
L-AOA SENSOR NO. 1
R-AOA SENSOR NO. 2
FLAP POWER DRIVE UNIT
FLAP ACTUATOR POSITION TRANSMITTER
YAW COMPUTER NO. 1
YAW COMPUTER NO. 2
PFCS MONITOR/ CONTROL PANEL
ALTITUDE SELECT PANEL
L.E. SLATS POWER DRIVE UNIT
PITCH AFT COUPLER LINEAR ACTUATOR (LEFT)
PITCH AFT COUPLER LINEAR ACTUATOR (RIGHT)
AFCS/MLG ACCESS UNIT
PITCH AFT COUPLER ASSY
FLAP CONTROL ASSEMBLY
FCES CONT PANEL
STAB PWR SERVO (LEFT)
STAB PWR SERVO (RIGHT)
CAPT PITCH CABLE BREAK DETECTOR
F/O PITCH CABLE BREAK DETECTOR
CAPT ROLL TORQUE LIMITER NO. 1
F/O ROLL TORQUE LIMITER NO. 2
CAPT PITCH BUNGEE NO. 1
F/O PITCH BUNGEE NO. 2
THROTTLE QUAD A LH
THROTTLE QUAD B CTR
THROTTLE QUAD C RH
+ 28V DC REG RECTIFIED BA (F1A)
+ 28V DC REG RECTIFIED BA (F1B)
+ 28V DC REG RECTIFIED BC (F2A)
+ 28V DC REG RECTIFIED BC (F2B)
NOTE
1 * CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 * CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 * CROSS REF. TO SHEET NO. IN SAME SCHEM
4 * NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-10-01 |
2 | 22-10-02 |
3 | 22-11-07 |
4 | 22-15-05 | 1
5 | 22-15-06 | 1
6 | 22-17-01 | 1
7 | 22-17-02 | 1
8 | 22-17-05 | 2
9 | 22-17-05 | 2
10 | 22-17-07 | 1
11 | 22-17-07 | 2
12 | 22-17-07 | 3
13 | 22-17-08 | 1
14 | 22-17-08 | 2
15 | 22-17-08 | 3

R FCES Computer Secondary Power Distribution
R SCHEM 2 (Sheet 2)

EFFECTIVITY: ALL

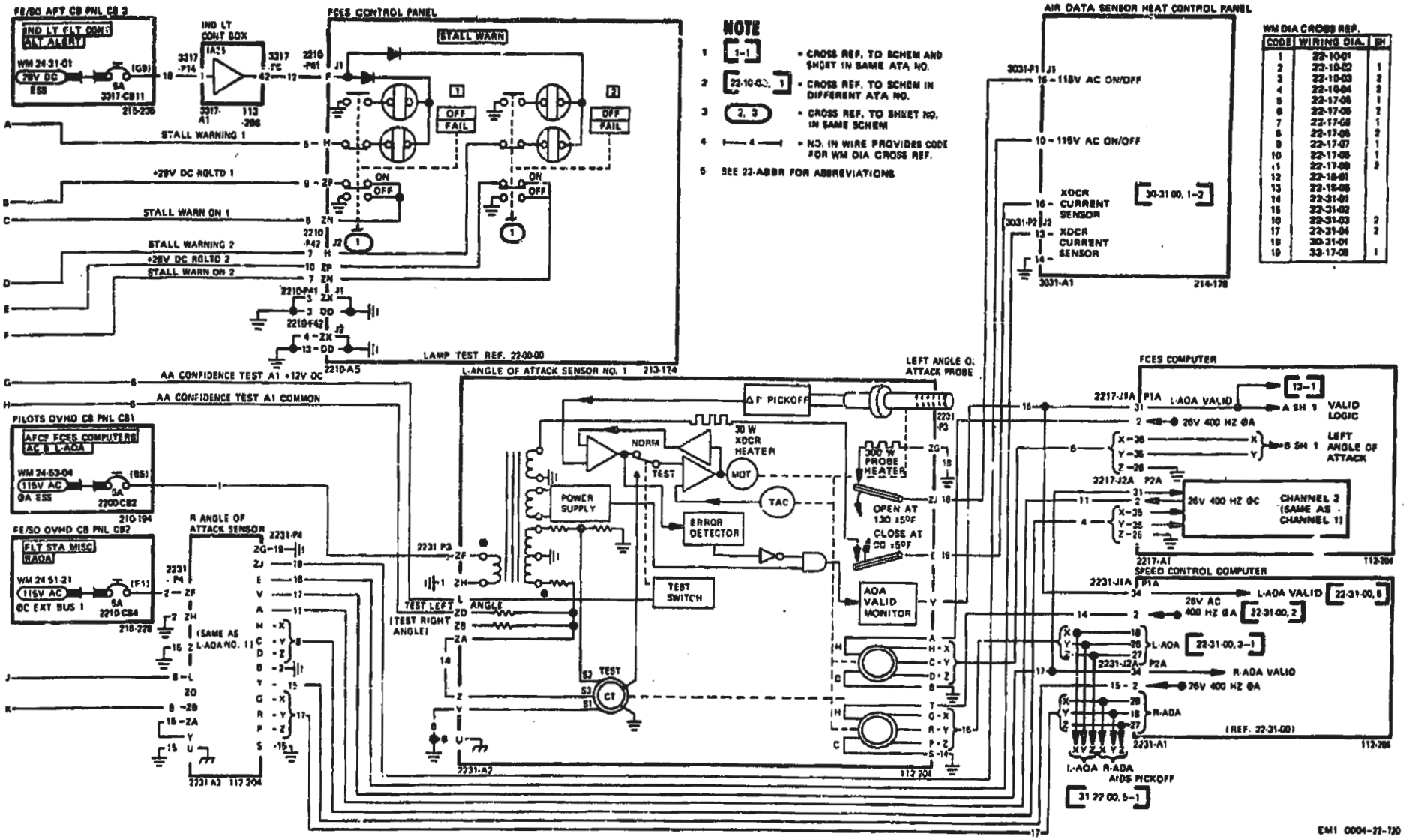
001B



R Stall Warning
R SCHEM 3 (Sheet 1)

EFFECTIVITY: ALL

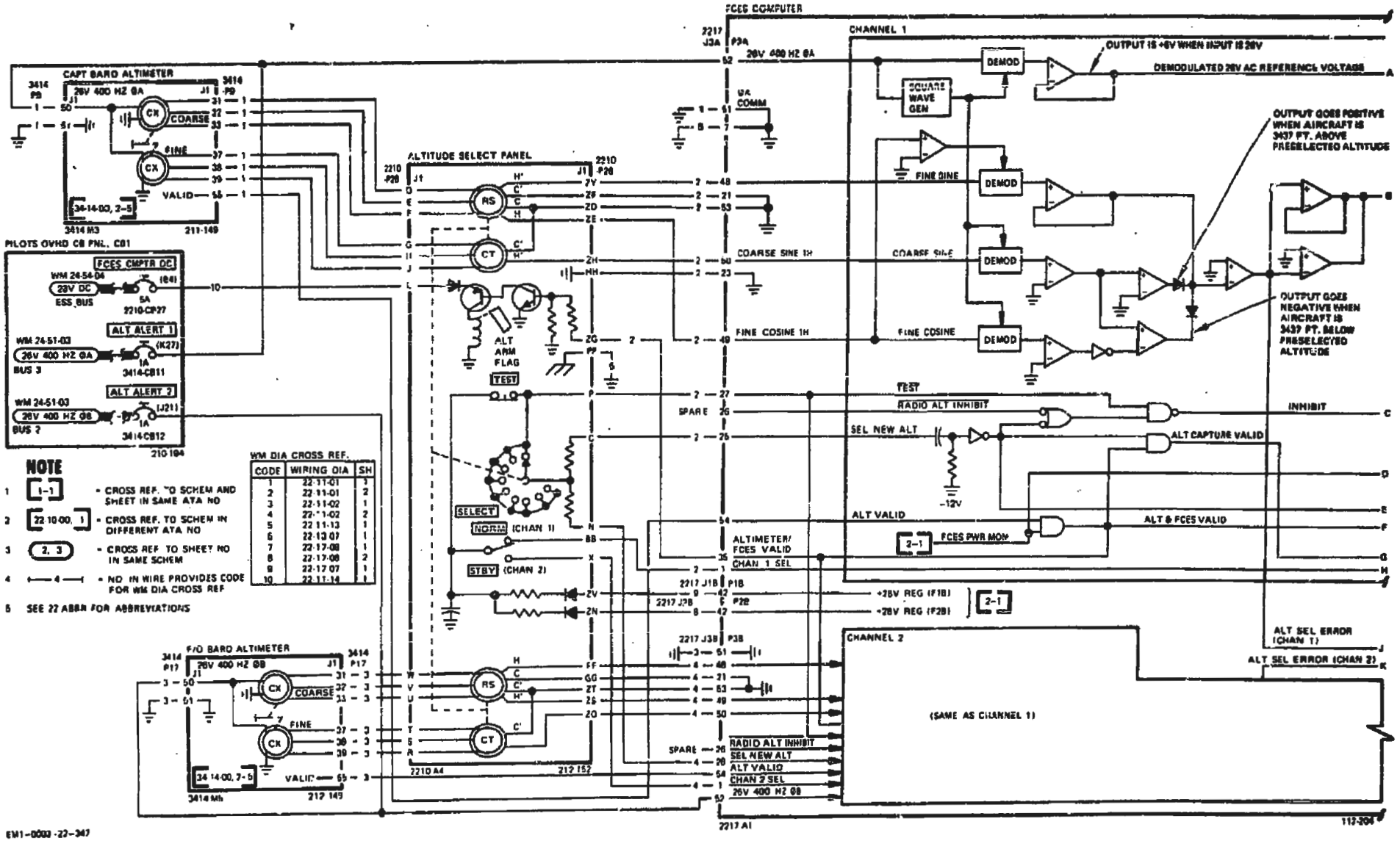
001B



R Stall Warning
R SCHEM 3 (Sheet 2)

EFFECTIVITY: ALL

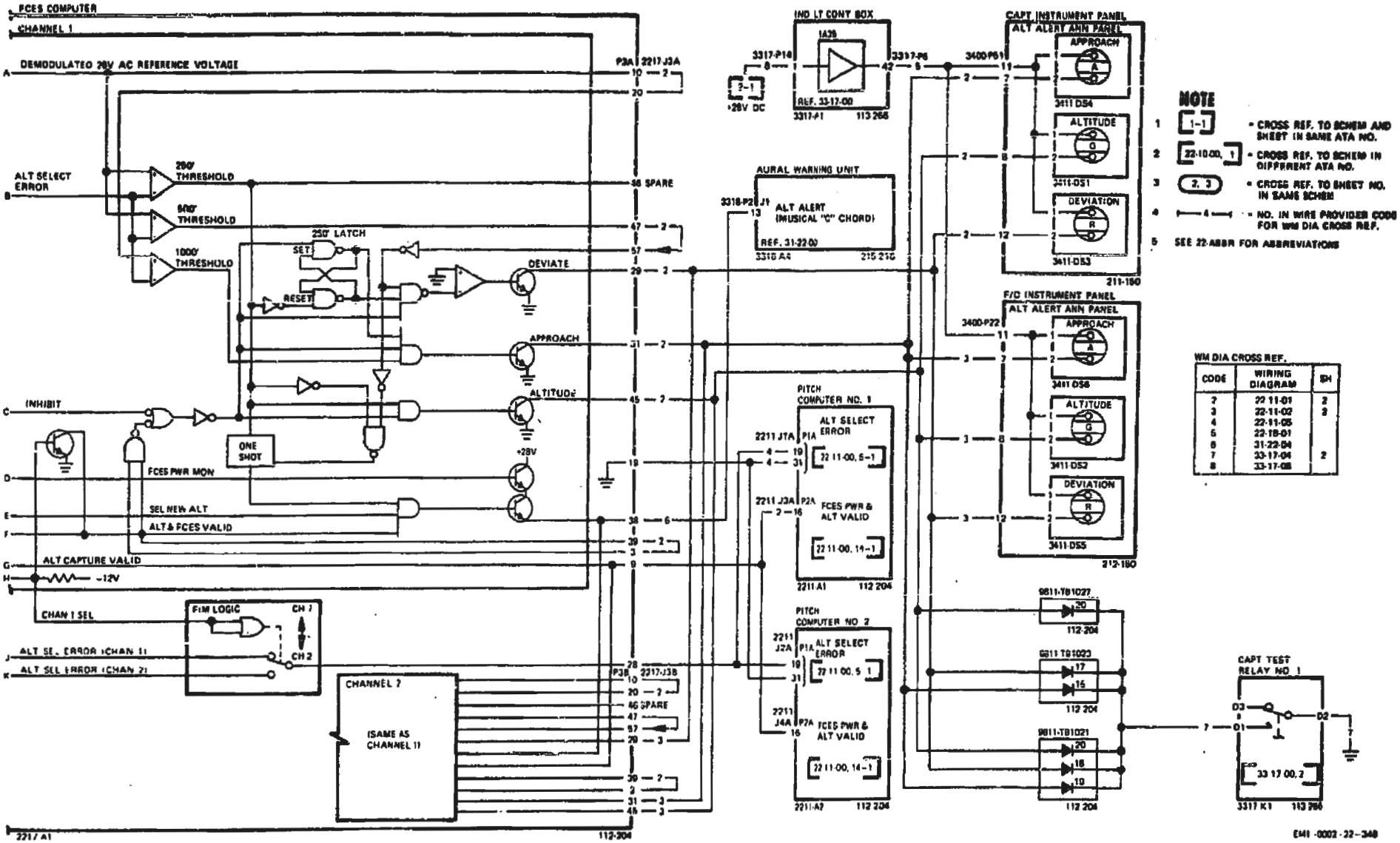
001B


FCES COMPUTER
CHANNEL 1
CAPT BARO ALTIMETER
ALTITUDE SELECT PANEL
PILOTS OVHD CB PNL. C81
FCES CMPTR DC
28V DC ESS BUS
ALT ALERT 1
ALT ALERT 2
BUS 3
BUS 2
F/O BARO ALTIMETER
COARSE
FINE
VALID
COARSE SINE 1H
FINE SINE
FINE COSINE 1H
FINE COSINE
ALT ARM FLAG
TEST
SELECT
NORM (CHAN 1)
STBY (CHAN 2)
SPARE
RADIO ALT INHIBIT
SEL NEW ALT
ALT VALID
ALTIMETER/ FCES VALID
CHAN 1 SEL
CHAN 2 SEL
+28V REG (F1B)
+28V REG (F2B)
FCES PWR MON
ALT CAPTURE VALID
ALT & FCES VALID
INHIBIT
ALT SEL ERROR (CHAN 1)
ALT SEL ERROR (CHAN 2)
CHANNEL 2
(SAME AS CHANNEL 1)
OUTPUT IS +8V WHEN INPUT IS 28V
DEMODULATED 26V AC REFERENCE VOLTAGE
OUTPUT GOES POSITIVE WHEN AIRCRAFT IS 3437 FT. ABOVE PRESELECTED ALTITUDE
OUTPUT GOES NEGATIVE WHEN AIRCRAFT IS 3437 FT. BELOW PRESELECTED ALTITUDE
-12V
NOTE
1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO
2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO
3 (2, 3) - CROSS REF TO SHEET NO IN SAME SCHEM
4 —4— - NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5 SEE 22 ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-11-01 | 1
2 | 22-11-01 | 2
3 | 22-11-02 | 1
4 | 22-11-02 | 2
5 | 22-11-13 | 1
6 | 22-13-07 | 1
7 | 22-17-08 | 1
8 | 22-17-08 | 2
9 | 22-17-07 | 1
10 | 22-11-14 | 1
EM1-0000-22-347
112-304

Altitude Alert
SCHEM 4 (Sheet 1)

EFFECTIVITY: ALL

001B



NOTE

1. [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. [2, 3] - CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— - NO. IN WIRE PROVIDER CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

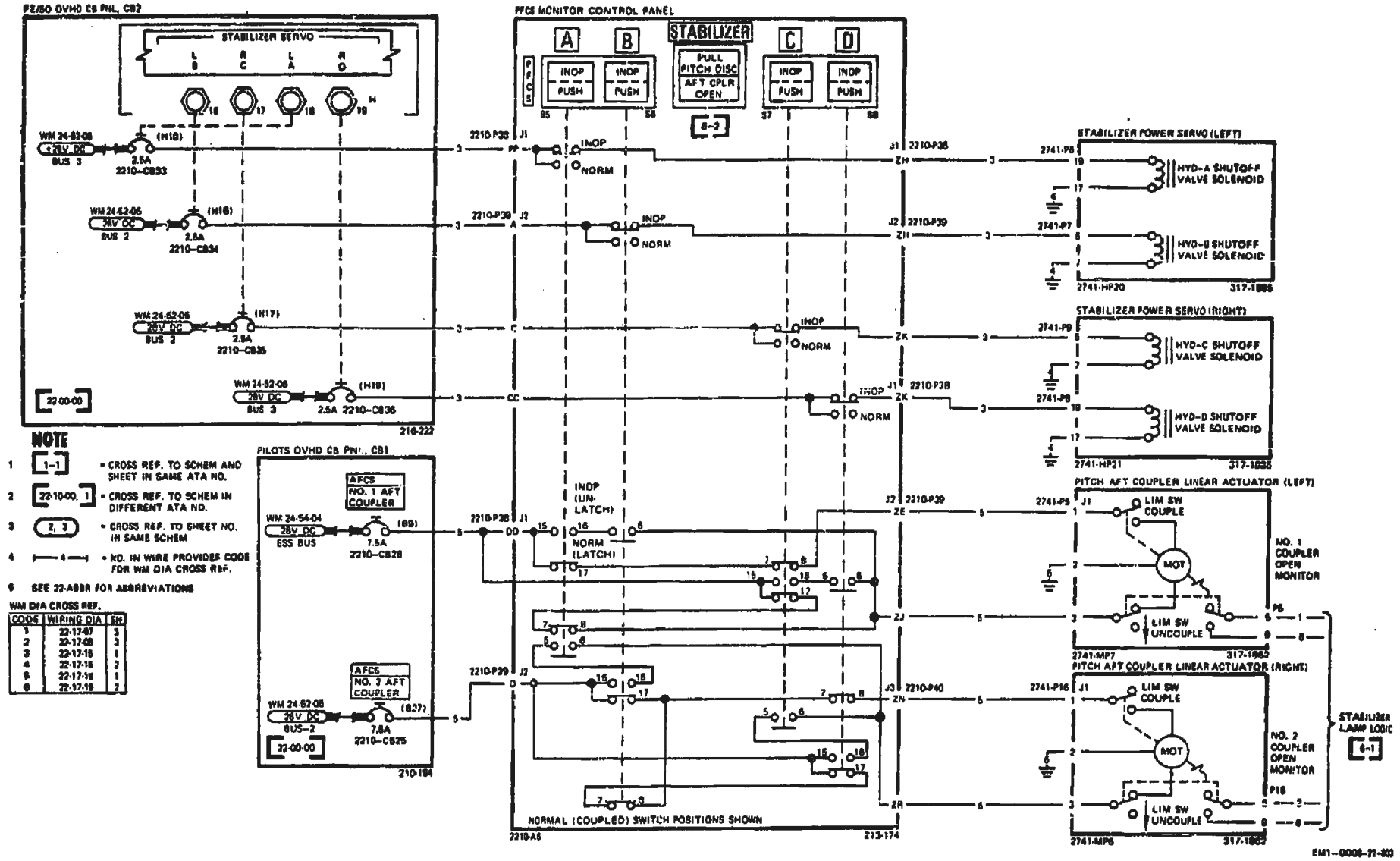
WM DIA CROSS REF.

CODE	WIRING DIAGRAM	SH
2	22 11-01	2
3	22-11-02	3
4	22-11-05	
5	22-18-01	
6	31-22-04	
7	33-17-04	2
8	33-17-05	

R Altitude Alert
R SCHEM 4 (Sheet 2)

EFFECTIVITY: ALL

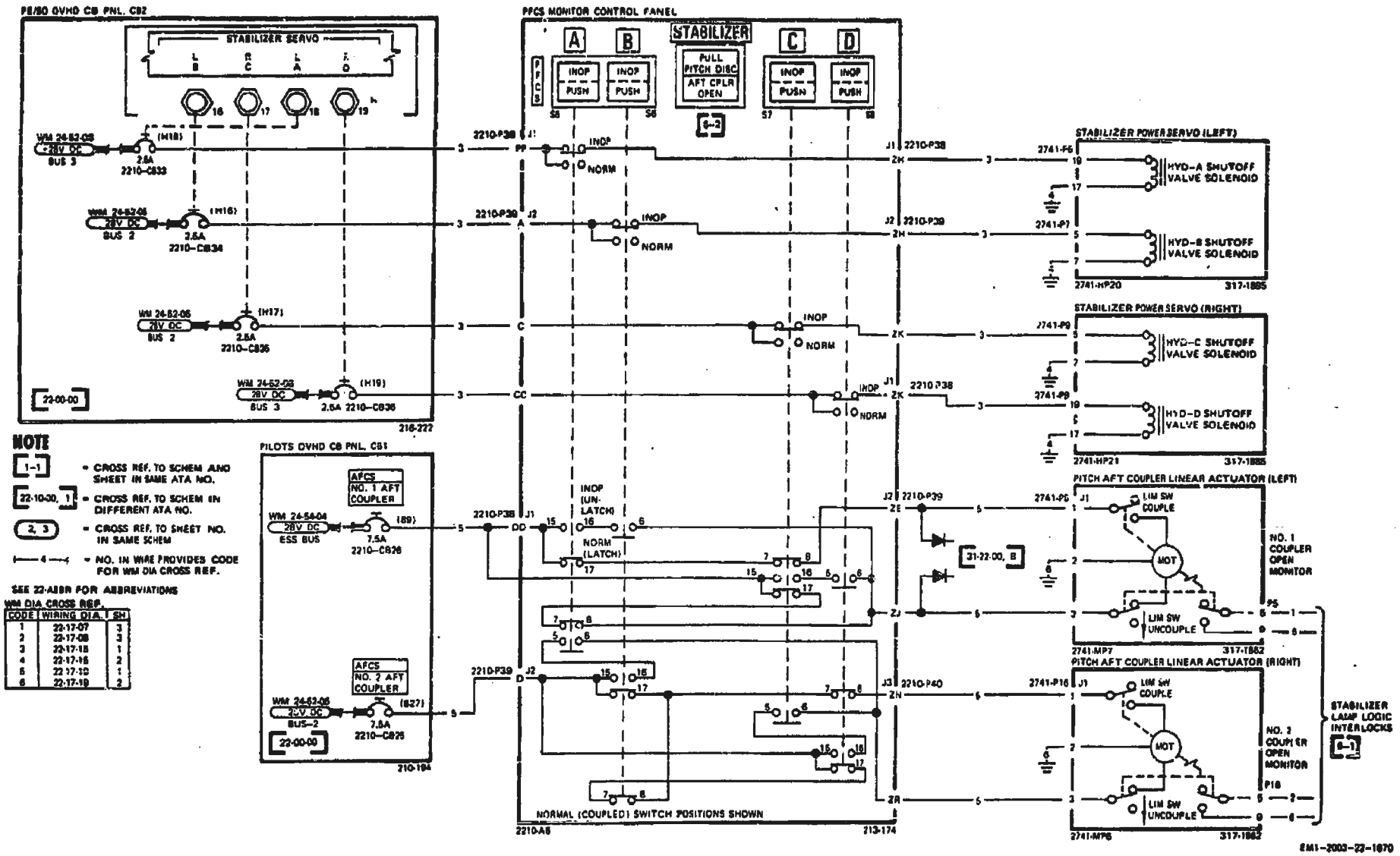
0018


P2/50 OVHD CB PNL, CB2
STABILIZER SERVO
PFCS MONITOR CONTROL PANEL
STABILIZER
PULL PITCH DISC
AFT CPLR OPEN
INOP
PUSH
NORM
STABILIZER POWER SERVO (LEFT)
HYD-A SHUTOFF VALVE SOLENOID
HYD-B SHUTOFF VALVE SOLENOID
STABILIZER POWER SERVO (RIGHT)
HYD-C SHUTOFF VALVE SOLENOID
HYD-D SHUTOFF VALVE SOLENOID
PILOTS OVHD CB PNL, CB1
AFCS NO. 1 AFT COUPLER
AFCS NO. 2 AFT COUPLER
ESS BUS
BUS 3
BUS 2
BUS-2
INOP (UN-LATCH)
NORM (LATCH)
PITCH AFT COUPLER LINEAR ACTUATOR (LEFT)
PITCH AFT COUPLER LINEAR ACTUATOR (RIGHT)
LIM SW COUPLE
LIM SW UNCOUPLE
MOT
NO. 1 COUPLER OPEN MONITOR
NO. 2 COUPLER OPEN MONITOR
STABILIZER LAMP LOGIC
NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— • NO. IN WIRE PROVIDER CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-17-07 | 3
2 | 22-17-08 | 3
3 | 22-17-15 | 1
4 | 22-17-15 | 2
5 | 22-17-15 | 1
6 | 22-17-15 | 2
NORMAL (COUPLED) SWITCH POSITIONS SHOWN
2210-A5
213-174
EM1-0008-22-400

R
R
R Stabilizer Hydraulics and Pitch Aft Coupler Control
SCHEM 5

EFFECTIVITY: 001-006, 008-031 WITHOUT SB093-27-174

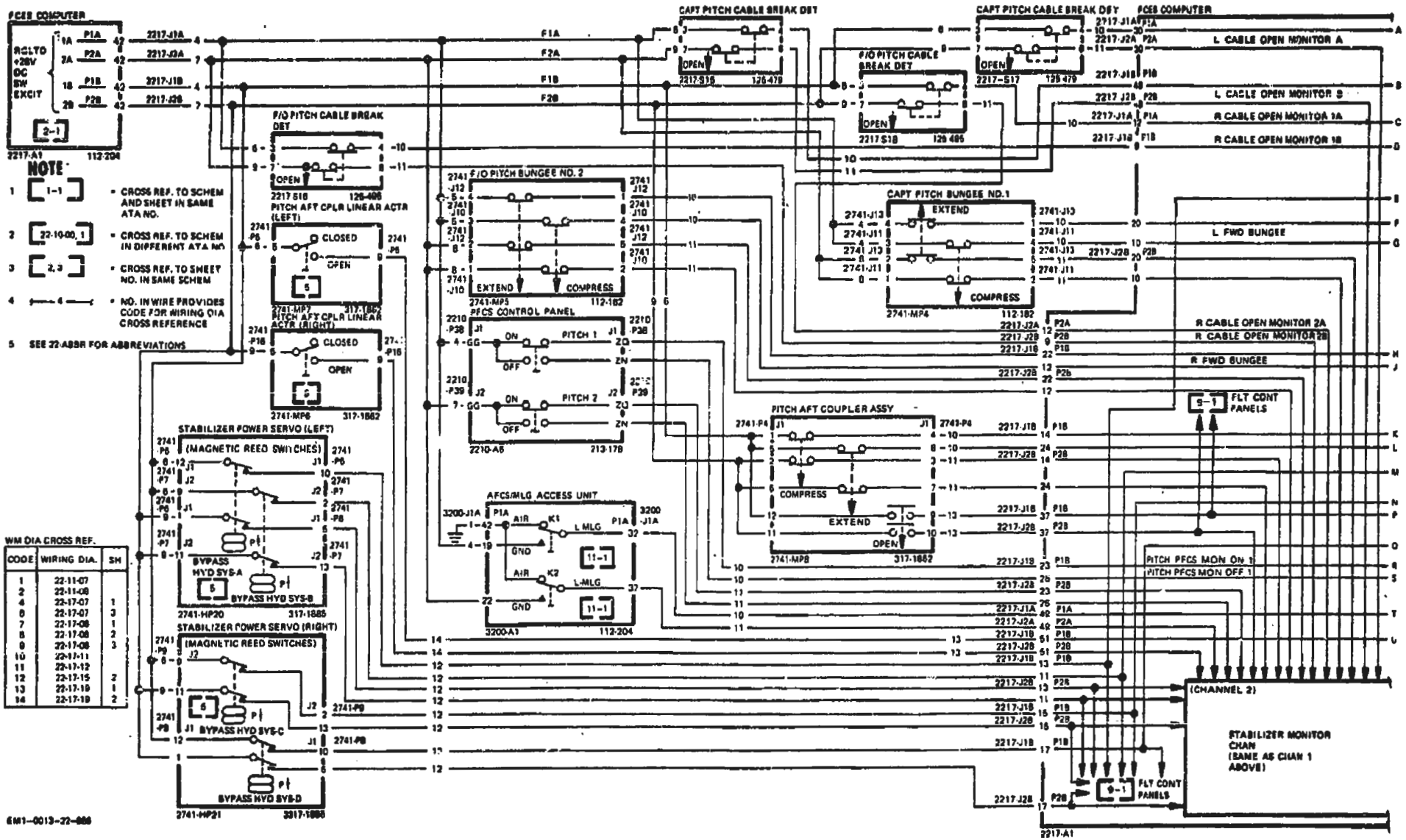
001B


P5/80 OVHD CB PNL, CB2
STABILIZER SERVO
PFCS MONITOR CONTROL PANEL
STABILIZER
PULL PITCH DISC AFT CPLR OPEN
INOP
PUSH
NORM
STABILIZER POWER SERVO (LEFT)
HYD-A SHUTOFF VALVE SOLENOID
HYD-B SHUTOFF VALVE SOLENOID
STABILIZER POWER SERVO (RIGHT)
HYD-C SHUTOFF VALVE SOLENOID
HYD-D SHUTOFF VALVE SOLENOID
PILOTS OVHD CB PNL, CB1
AFCS NO. 1 AFT COUPLER
AFCS NO. 2 AFT COUPLER
INOP (UN-LATCH)
NORM (LATCH)
PITCH AFT COUPLER LINEAR ACTUATOR (LEFT)
PITCH AFT COUPLER LINEAR ACTUATOR (RIGHT)
LIM SW COUPLE
LIM SW UNCOUPLE
MOT
NO. 1 COUPLER OPEN MONITOR
NO. 2 COUPLER OPEN MONITOR
STABILIZER LAMP LOGIC INTERLOCKS
NORMAL (COUPLED) SWITCH POSITIONS SHOWN
NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-17-07 | 3
2 | 22-17-08 | 3
3 | 22-17-15 | 1
4 | 22-17-16 | 2
5 | 22-17-18 | 1
6 | 22-17-19 | 2
EM1-2003-22-1070

R
R
R Stabilizer Hydraulics and Pitch Aft Coupler Control
SCHEM 5

EFFECTIVITY: 001-006, 008-031 WITH SB093-27-174 AND 032-999

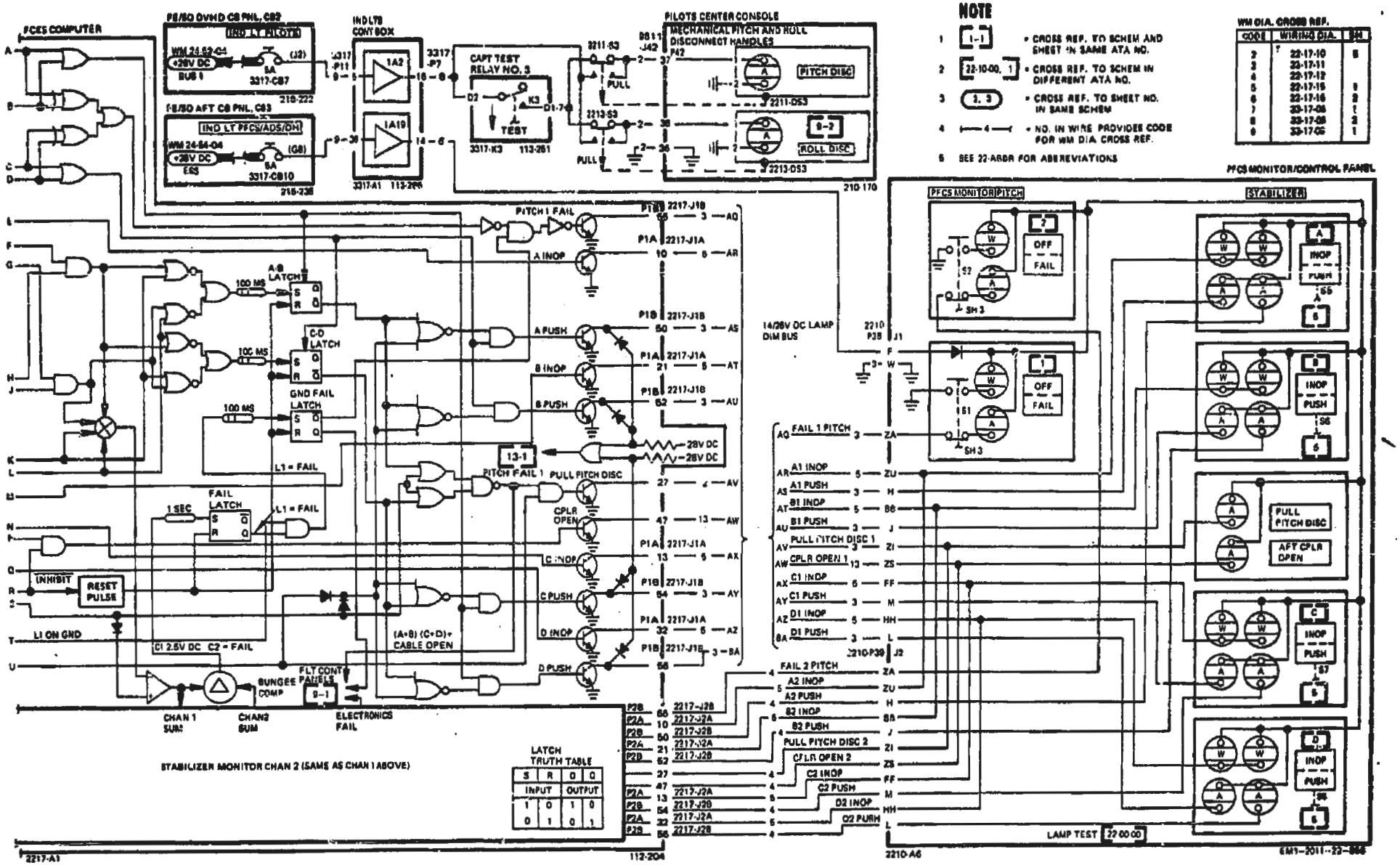
001B


FCES COMPUTER
NOTE
WM DIA CROSS REF.
CODE | WIRING DIA. | SH
STABILIZER POWER SERVO (LEFT)
STABILIZER POWER SERVO (RIGHT)
(MAGNETIC REED SWITCHES)
BYPASS HYD SYS-A
BYPASS HYD SYS-B
BYPASS HYD SYS-C
BYPASS HYD SYS-D
F/O PITCH CABLE BREAK DET
CAPT PITCH CABLE BREAK DET
F/O PITCH BUNGEE NO. 2
CAPT PITCH BUNGEE NO. 1
PFCS CONTROL PANEL
PITCH AFT COUPLER ASSY
AFCS/MLG ACCESS UNIT
PITCH AFT CPLR LINEAR ACTR (LEFT)
PITCH AFT CPLR LINEAR ACTR (RIGHT)
L CABLE OPEN MONITOR A
L CABLE OPEN MONITOR B
R CABLE OPEN MONITOR 2A
R CABLE OPEN MONITOR 2B
L FWD BUNGEE
R FWD BUNGEE
FLT CONT PANELS
PITCH PFCS MON ON 1
PITCH PFCS MON OFF 1
(CHANNEL 2)
STABILIZER MONITOR CHAN (SAME AS CHAN 1 ABOVE)

R Stabilizer Annunciator Logic
R SCHEM 6 (Sheet 1)

EFFECTIVITY: ALL

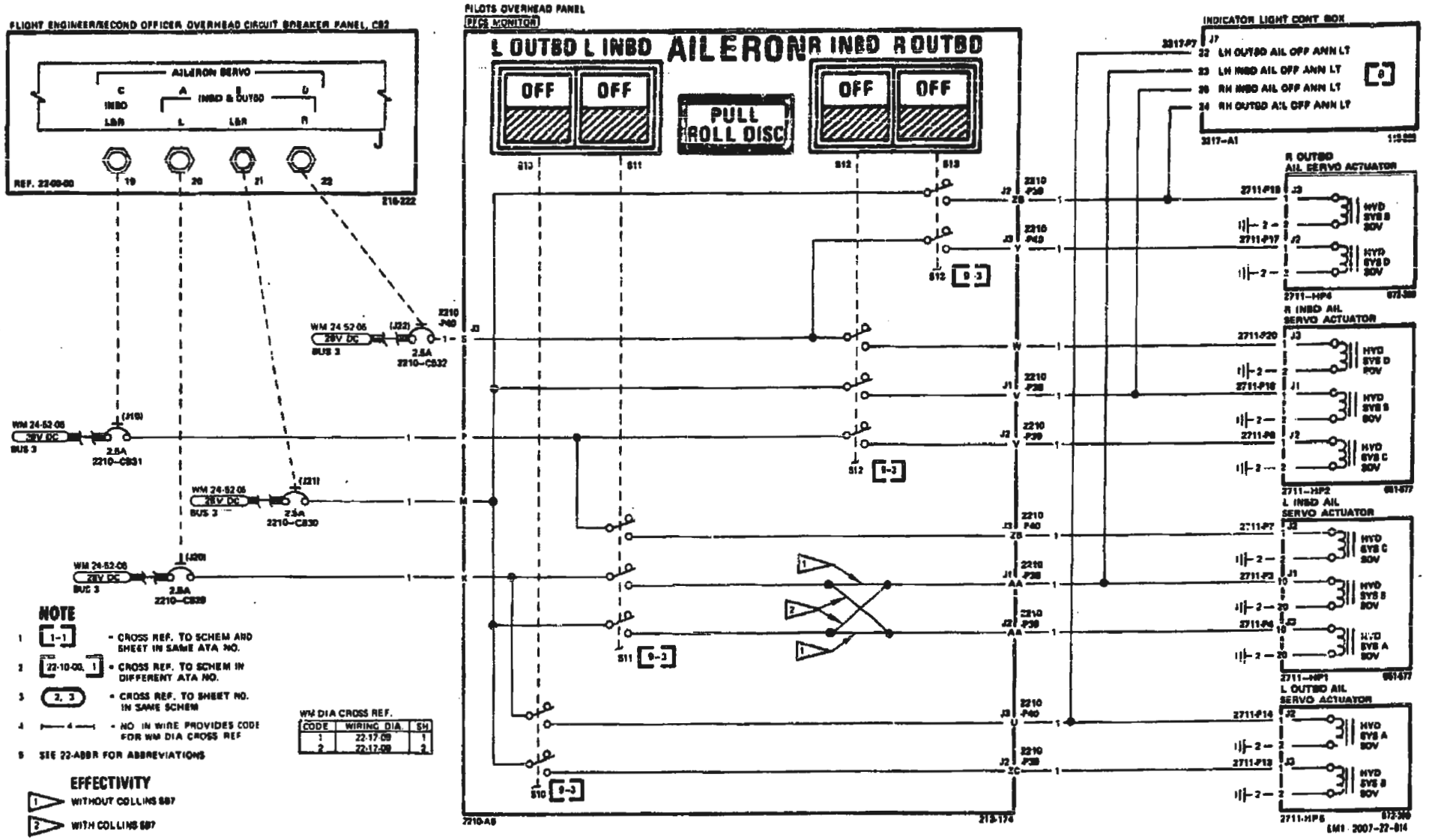
001B



R Stabilizer Annunciator Logic
R SCHEM 6 (Sheet 2)

EFFECTIVITY: ALL

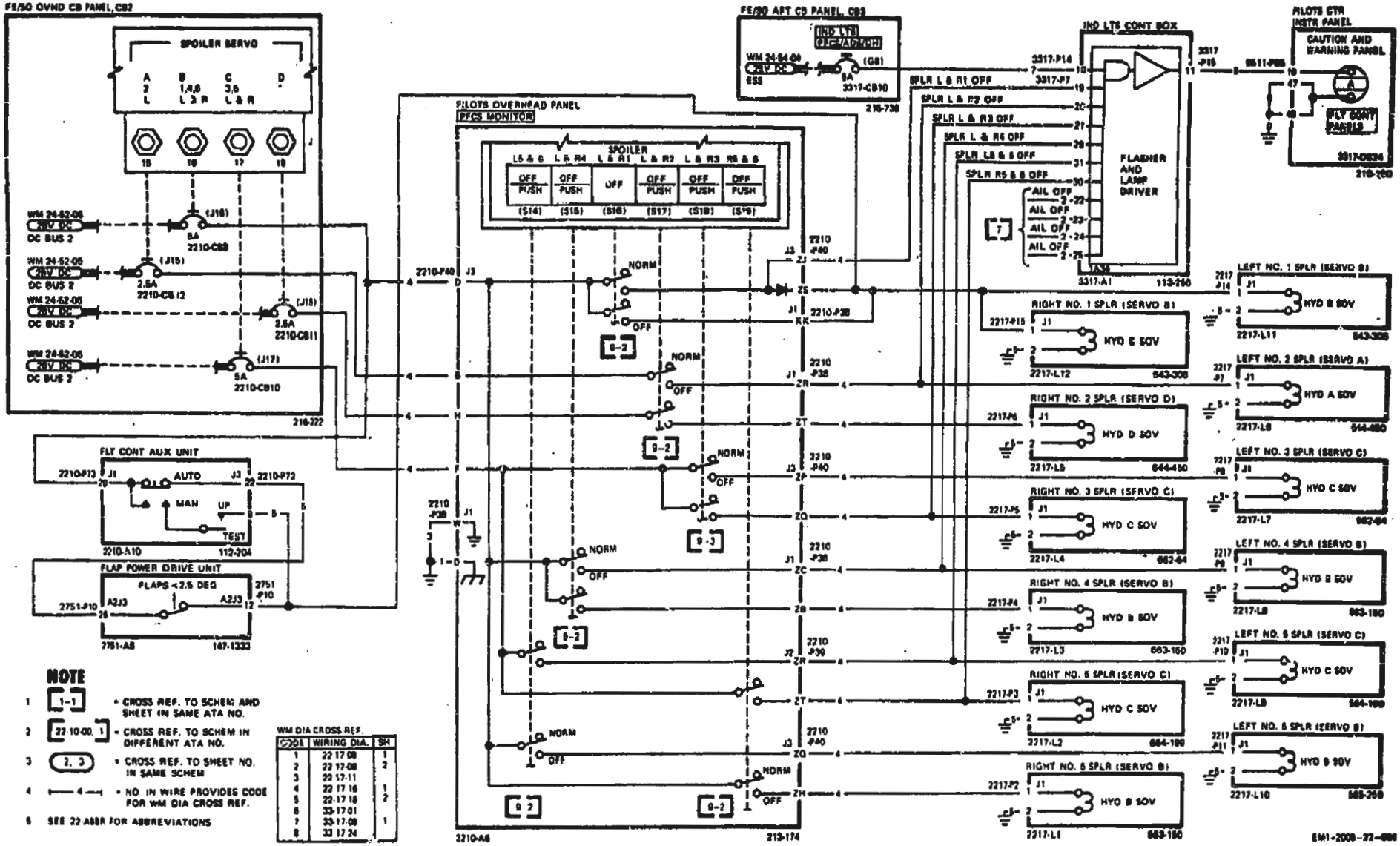
0018



R Aileron Hydraulics Control
R SCHEM 7

EFFECTIVITY: ALL

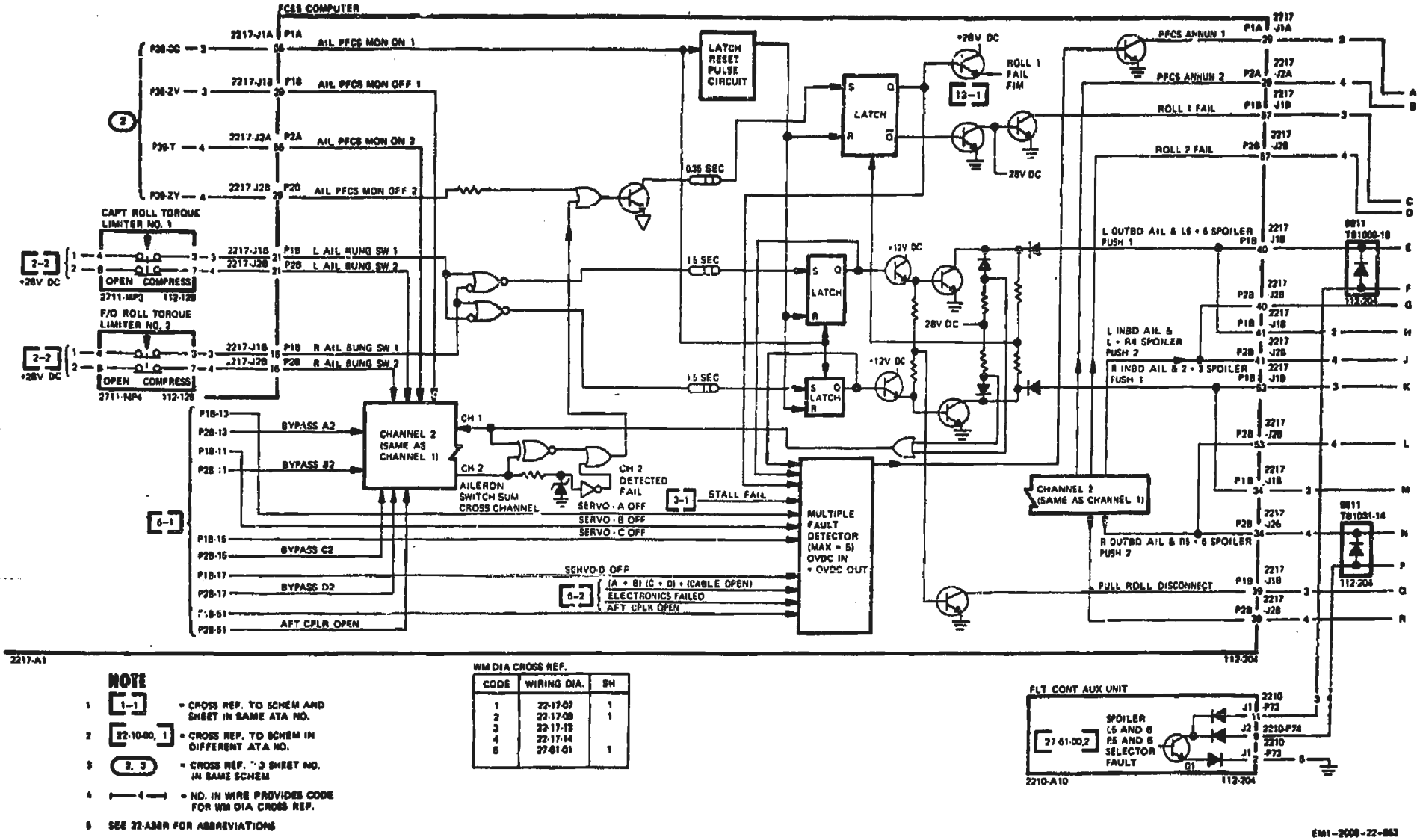
001B


FE/SO OVHD CB PANEL, CB2
SPOILER SERVO
A 2 L
B 1,4,6 L & R
C 3,5 L & R
D
WM 24-52-05 28V DC DC BUS 2
(J16) 5A 2210-CB9
(J15) 2.5A 2210-CB12
(J18) 2.5A 2210-CB11
(J17) 5A 2210-CB10
216-222
FLT CONT AUX UNIT
AUTO
MAN
UP
TEST
2210-A10
112-204
FLAP POWER DRIVE UNIT
FLAPS < 2.5 DEG
2751-A8
187-1333
PILOTS OVERHEAD PANEL
FFCS MONITOR
SPOILER
L5 & 6 OFF PUSH (S14)
L & R4 OFF PUSH (S15)
L & R1 OFF (S16)
L & R2 OFF PUSH (S17)
L & R3 OFF PUSH (S18)
R6 & 6 OFF PUSH (S19)
NORM
OFF
2210-A6
213-174
FE/SO APT CB PANEL, CB3
IND LTS OFF/DIM/BRT
WM 24-54-04 28V DC ESS
(CB1) 5A 3317-CB10
216-736
IND LTS CONT BOX
FLASHER AND LAMP DRIVER
3317-A1
113-266
SPLR L & R1 OFF
SPLR L & R2 OFF
SPLR L & R3 OFF
SPLR L & R4 OFF
SPLR L5 & 6 OFF
SPLR R5 & 6 OFF
AIL OFF
PILOTS CTR INSTR PANEL
CAUTION AND WARNING PANEL
FLY CONT PANEL
3317-CB26
216-269
LEFT NO. 1 SPLR (SERVO B)
RIGHT NO. 1 SPLR (SERVO B)
LEFT NO. 2 SPLR (SERVO A)
RIGHT NO. 2 SPLR (SERVO D)
LEFT NO. 3 SPLR (SERVO C)
RIGHT NO. 3 SPLR (SERVO C)
LEFT NO. 4 SPLR (SERVO B)
RIGHT NO. 4 SPLR (SERVO B)
LEFT NO. 5 SPLR (SERVO C)
RIGHT NO. 5 SPLR (SERVO C)
LEFT NO. 6 SPLR (SERVO B)
RIGHT NO. 6 SPLR (SERVO B)
HYD B SOV
HYD A SOV
HYD D SOV
HYD C SOV
NOTE
1 [1-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 [2, 3] • CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— • NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
CODE 1 WIRING DIA. 22 17 08 SH 1
2 22 17 08 2
3 22 17 11
4 22 17 16 1
5 22 17 16 2
6 33 17 01
7 33 17 08 1
8 33 17 24
E141-2000-22-000

R Spoiler Hydraulics Control
R SCHEM 8

EFFECTIVITY: ALL

001B



NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA CROSS REF.

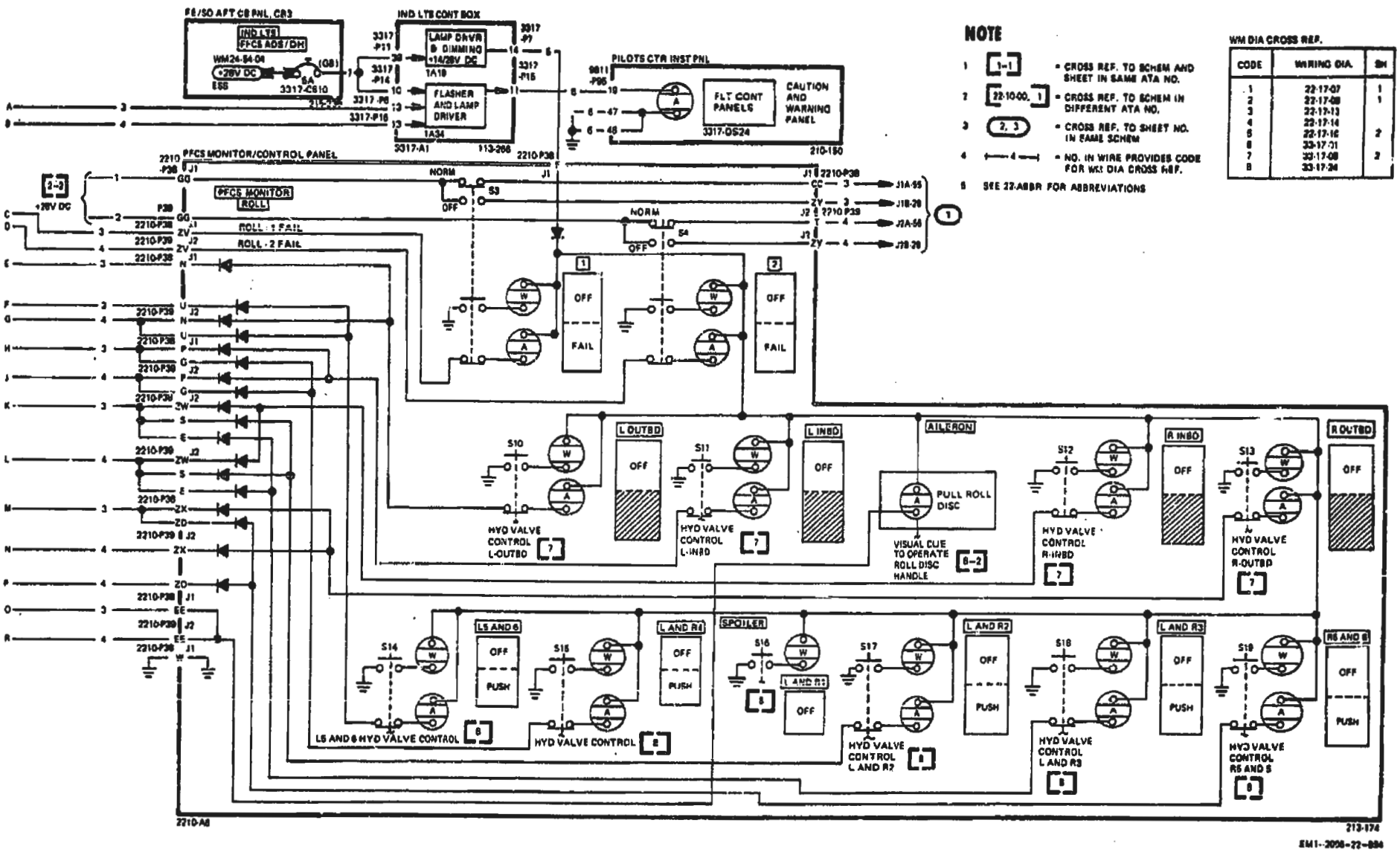
CODE	WIRING DIA.	SH
1	22-17-07	1
2	22-17-08	1
3	22-17-13	
4	22-17-14	
5	27-61-01	1

EM1-2000-22-863

R Aileron and Spoiler Annunciator Logic
R SCHEM 9 (Sheet 1)

EFFECTIVITY: ALL

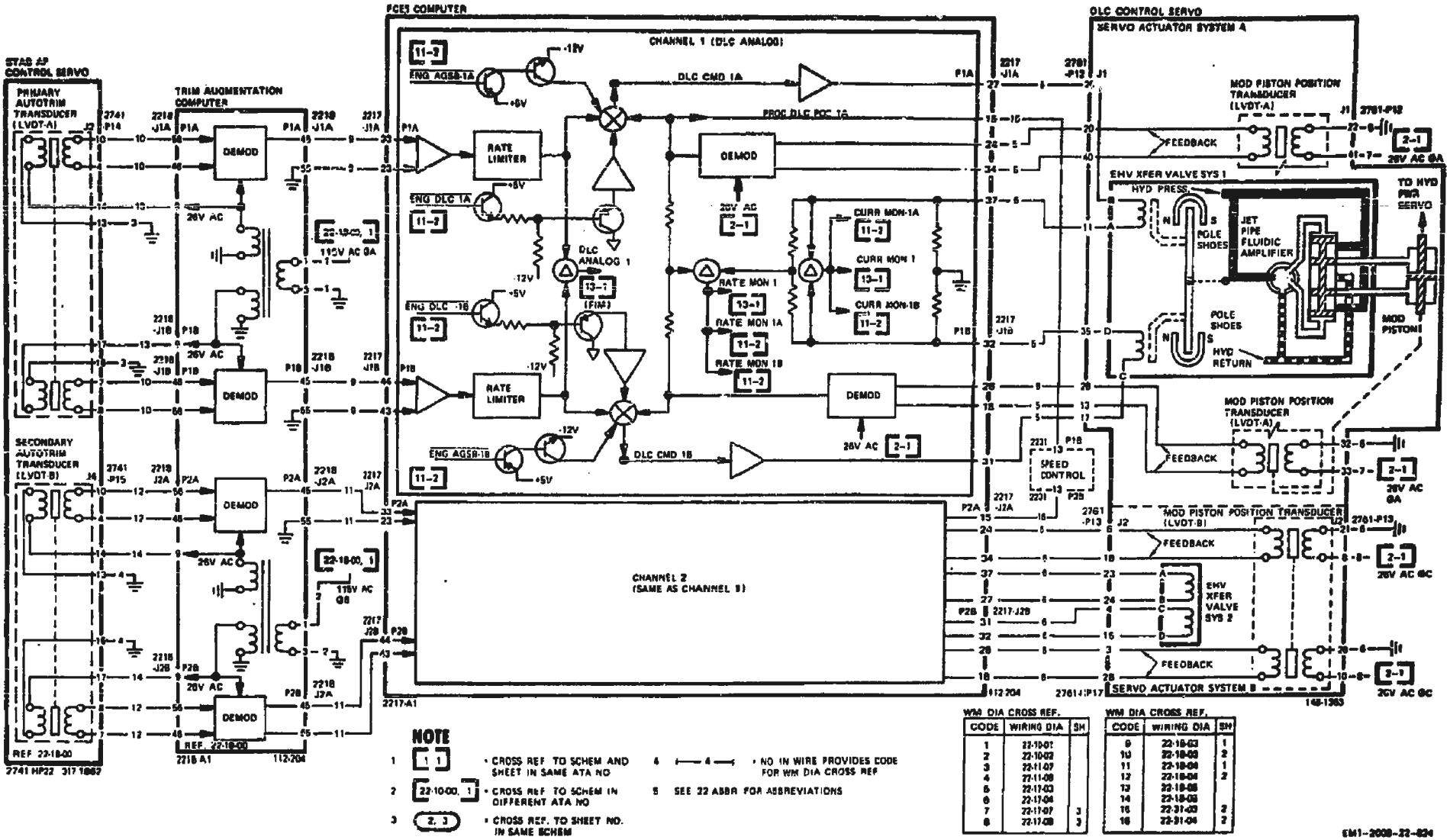
0018


NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— = NO. IN WIRE PROVIDES CODE FOR WIRE DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WIRE DIA CROSS REF.
CODE | WIRING DIA. | SH
1 | 22-17-07 | 1
2 | 22-17-08 | 1
3 | 22-17-13 |
4 | 22-17-14 |
5 | 22-17-16 | 2
6 | 33-17-01 |
7 | 33-17-08 | 2
8 | 33-17-24 |
F6/SO AFT CB PNL, CB3
IND LTS (PFCS ADS/DH)
IND LTR CONT BOX
LAMP DRVR & DIMMING +14/28V DC
FLASHER AND LAMP DRIVER
PILOTS CTR INST PNL
FLT CONT PANELS
CAUTION AND WARNING PANEL
PFCS MONITOR/CONTROL PANEL
PFCS MONITOR ROLL
ROLL - 1 FAIL
ROLL - 2 FAIL
HYD VALVE CONTROL L-OUTBD
HYD VALVE CONTROL L-INBD
PULL ROLL DISC
VISUAL CUE TO OPERATE ROLL DISC HANDLE
HYD VALVE CONTROL R-INBD
HYD VALVE CONTROL R-OUTBD
LS AND 6 HYD VALVE CONTROL
HYD VALVE CONTROL
HYD VALVE CONTROL L AND R2
HYD VALVE CONTROL L AND R3
HYD VALVE CONTROL R5 AND 6
L OUTBD
L INBD
AILERON
R INBD
R OUTBD
LS AND 6
L AND R4
SPOILER
L AND R2
L AND R3
R5 AND 6
OFF
FAIL
PUSH
213-174

R Aileron and Spoiler Annunciator Logic
R SCHEM 9 (Sheet 2)

EFFECTIVITY: ALL

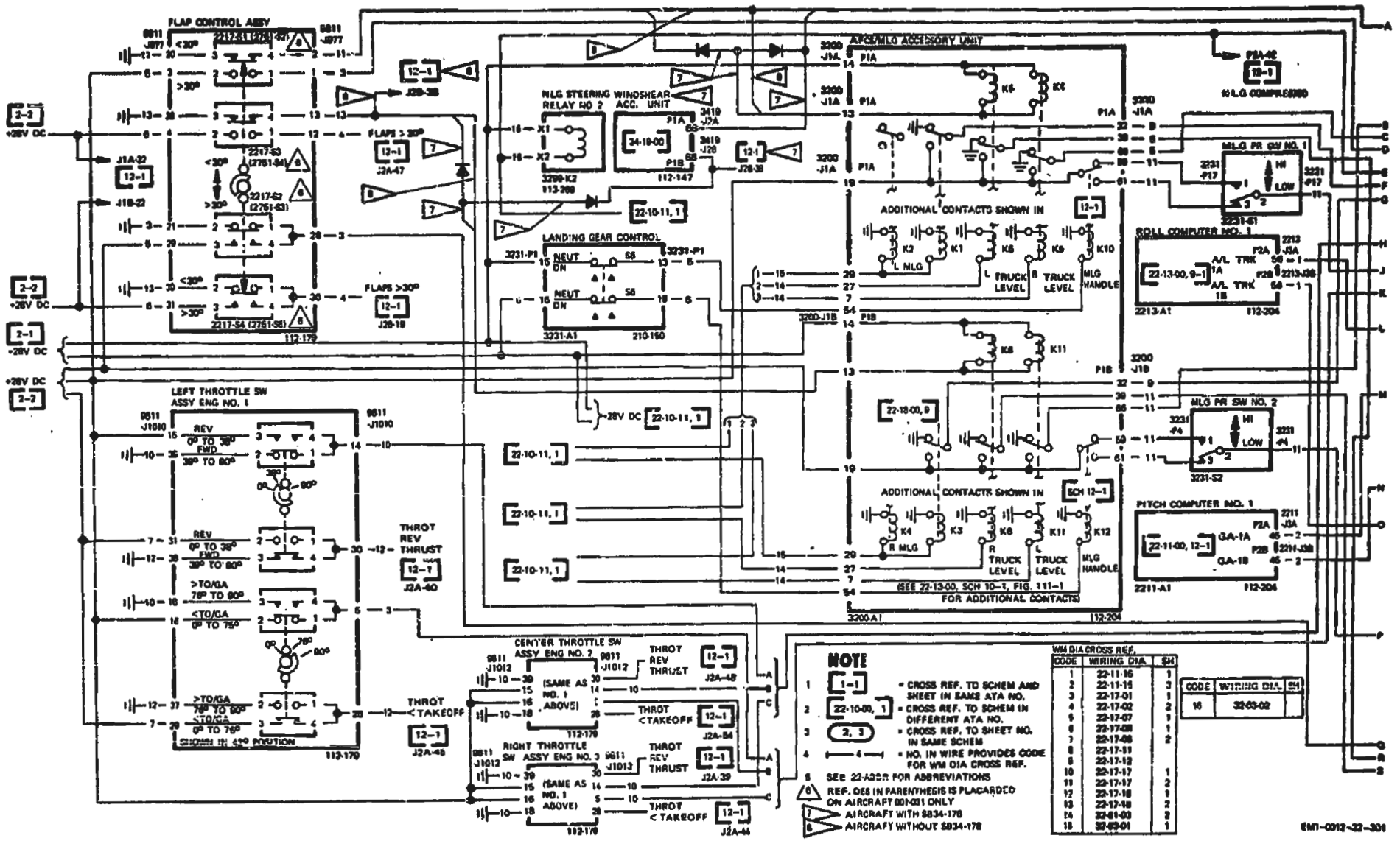
001B



R DLC/AGSB Analog Signal Flow Schematic
R SCHEM 10

EFFECTIVITY: ALL

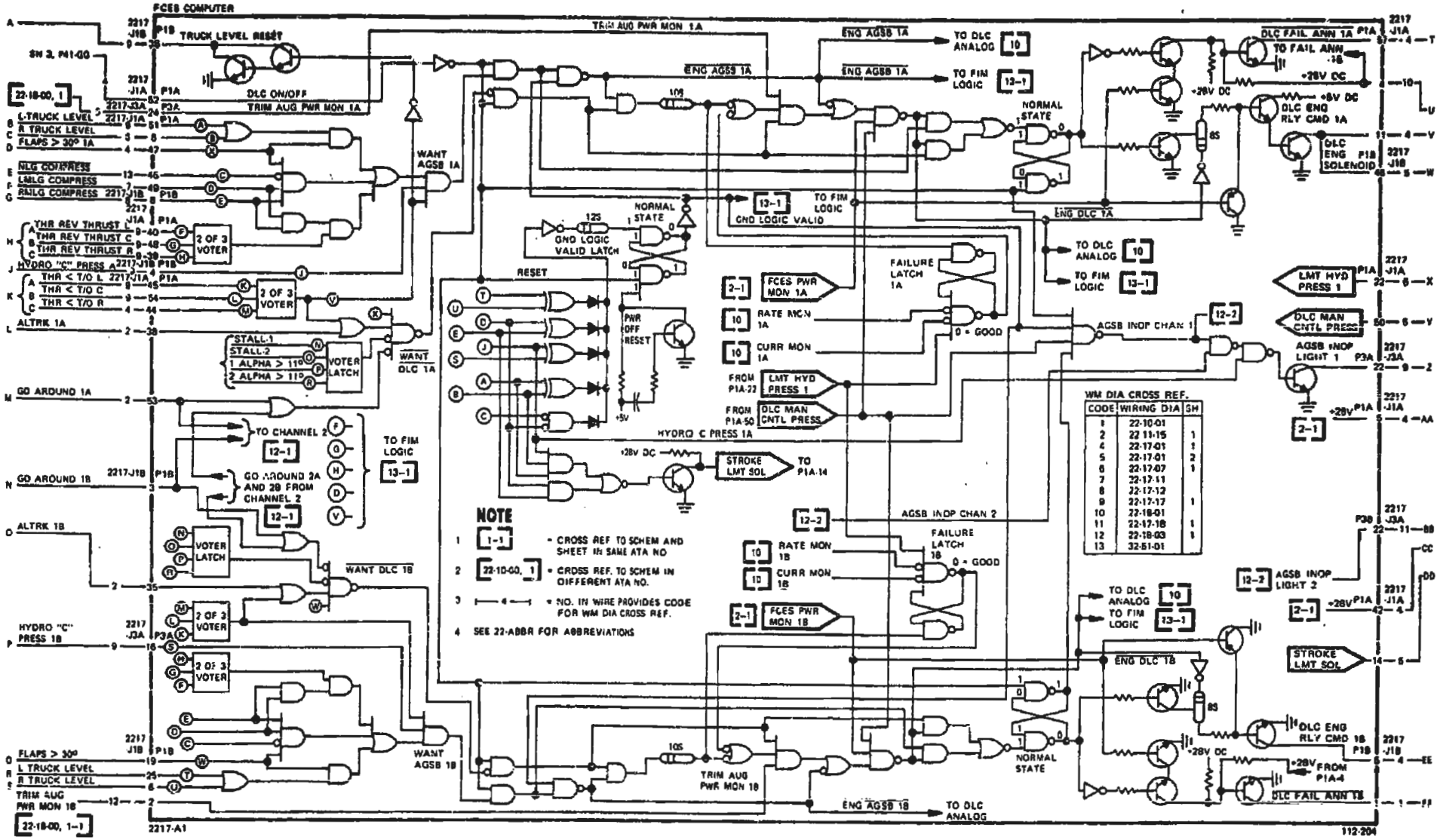
001B



R DLC/AGSB System No. 1 Logic
R SCHEM 11 (Sheet 1)

EFFECTIVITY: ALL

001B

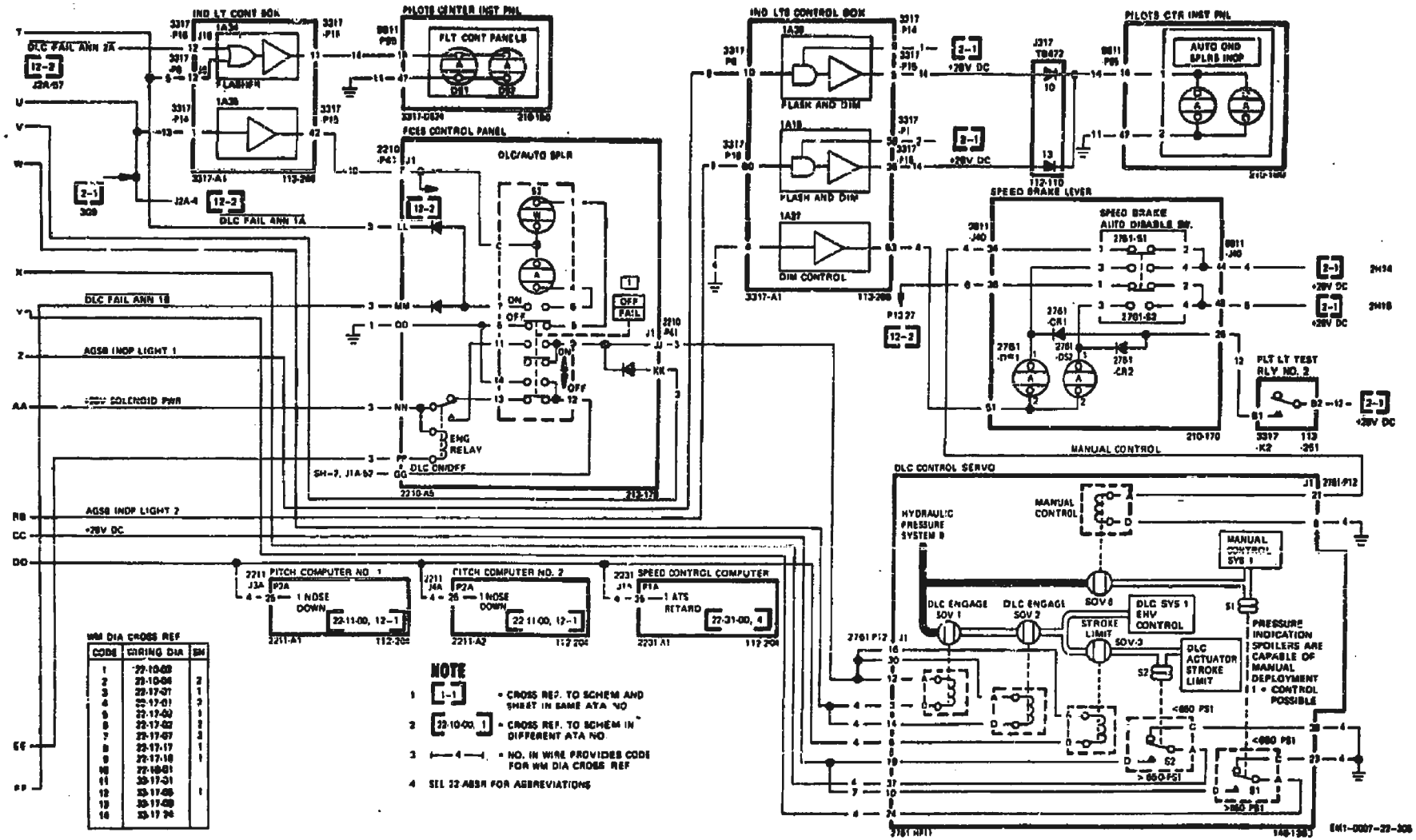


EM1-0014-22-304

R DLC/AGSB System No.1 Logic Schematic
R SCHEM 11 (Sheet 2)

EFFECTIVITY: ALL

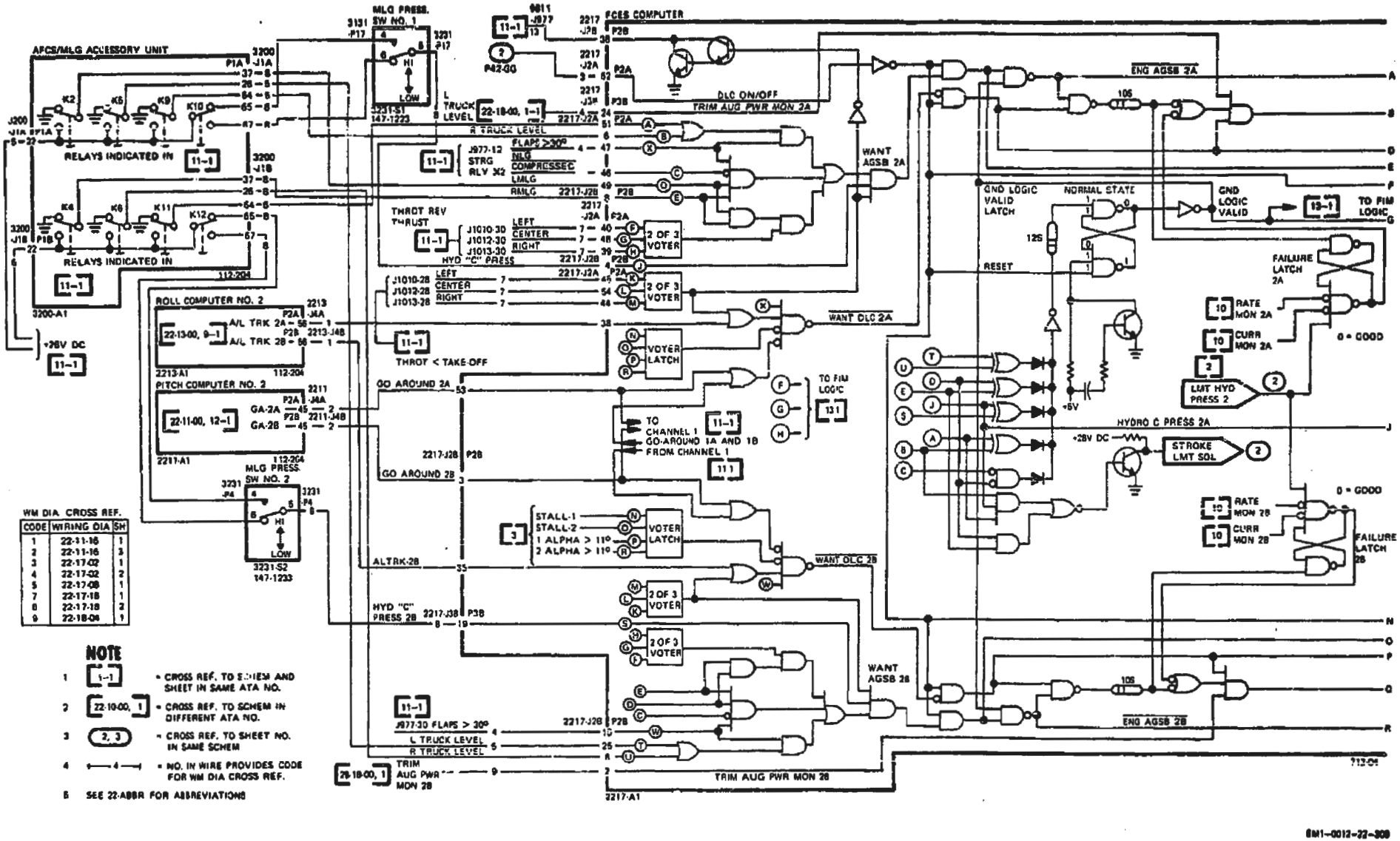
0018


IND LT CONT BOX
PILOTS CENTER INST PNL
FLT CONT PANELS
FCES CONTROL PANEL
OLC/AUTO SPLR
IND LTS CONTROL BOX
FLASH AND DIM
DIM CONTROL
PILOTS CTR INST PNL
AUTO GND SPLRS INOP
SPEED BRAKE LEVER
SPEED BRAKE AUTO DISABLE SW.
MANUAL CONTROL
PLT LT TEST RLY NO. 2
DLC CONTROL SERVO
HYDRAULIC PRESSURE SYSTEM B
DLC ENGAGE SOV 1
DLC ENGAGE SOV 2
SOV 3
DLC SYS 1 ENV CONTROL
STROKE LIMIT
DLC ACTUATOR STROKE LIMIT
PRESSURE INDICATION SPOILERS ARE CAPABLE OF MANUAL DEPLOYMENT
1 = CONTROL POSSIBLE
DLC FAIL ANN 2A
DLC FAIL ANN 1A
DLC FAIL ANN 1B
AGSB INOP LIGHT 1
AGSB INOP LIGHT 2
+28V DC
ENG RELAY
DLC ON/OFF
2211 PITCH COMPUTER NO. 1
2211 PITCH COMPUTER NO. 2
2231 SPEED CONTROL COMPUTER
1 NOSE DOWN
1 ATS RETARD
WM DIA CROSS REF
NOTE
1 = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO
2 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO
3 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
4 SEE 22 ABBR FOR ABBREVIATIONS

R DLC/AGSB System No. 1 Logic
R SCHEM 11 (Sheet 3)

EFFECTIVITY: ALL

001B



CODE	WIRING DIA	SH
1	22-11-16	1
2	22-11-16	3
3	22-17-02	1
4	22-17-02	2
5	22-17-08	1
7	22-17-18	1
8	22-17-18	2
9	22-18-04	1

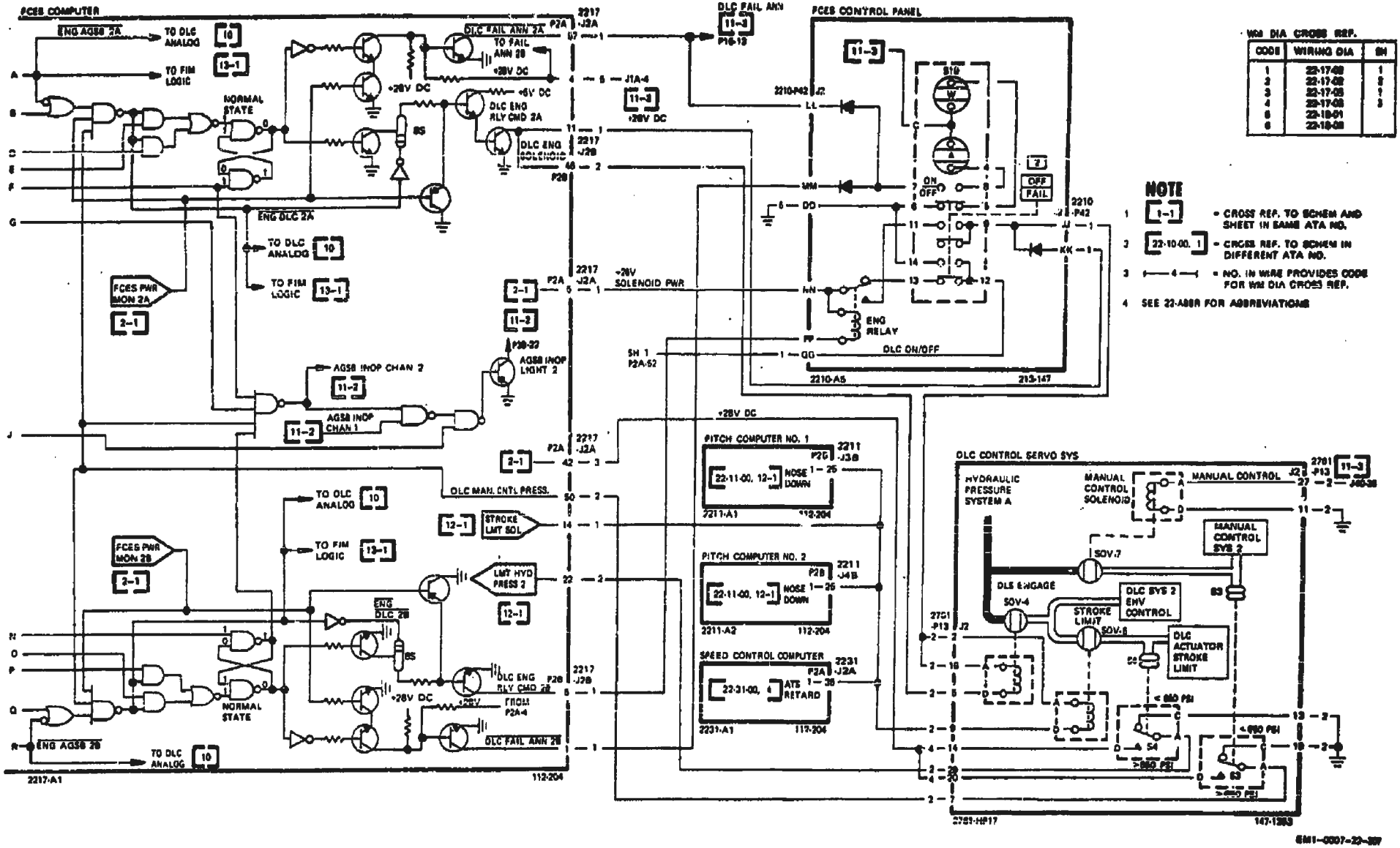
8M1-0012-22-309

R
R

DLC/AGSB System No. 2 Logic
SCHEM 12 (Sheet 1)

EFFECTIVITY: ALL

001B



WM DIA CROSS REF.		
CODE	WIRING DIA	SH
1	22-17-03	1
2	22-17-03	2
3	22-17-03	1
4	22-17-03	3
5	22-19-01	
6	22-19-03	

NOTE

1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

3 —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

4 SEE 22-AGSB FOR ABBREVIATIONS

R DLC/AGSB System No. 2 Logic
R SCHEM 12 (Sheet 2)

EFFECTIVITY: ALL

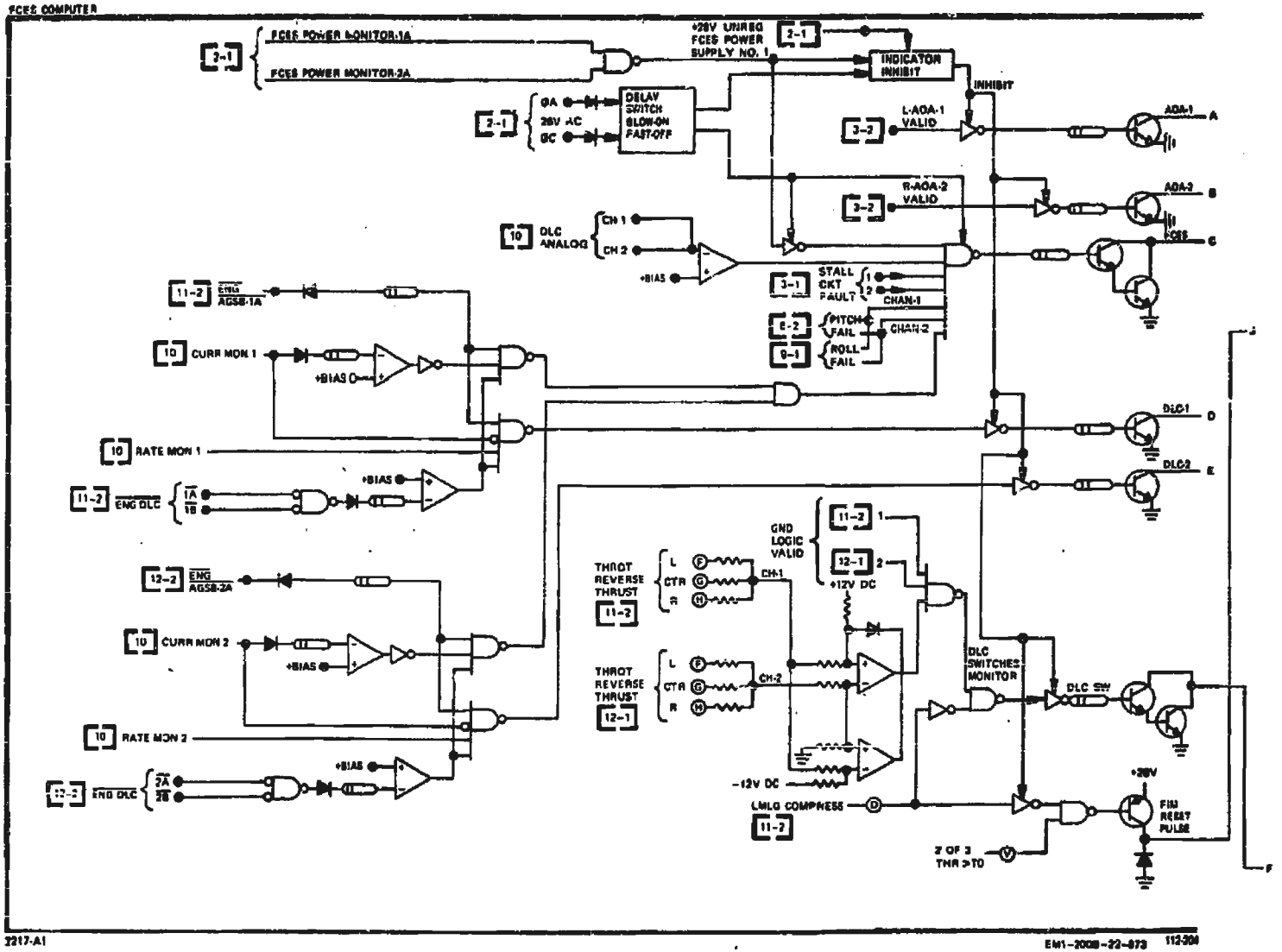
0018

NOTE

1. [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

WM DIA CROSS REF

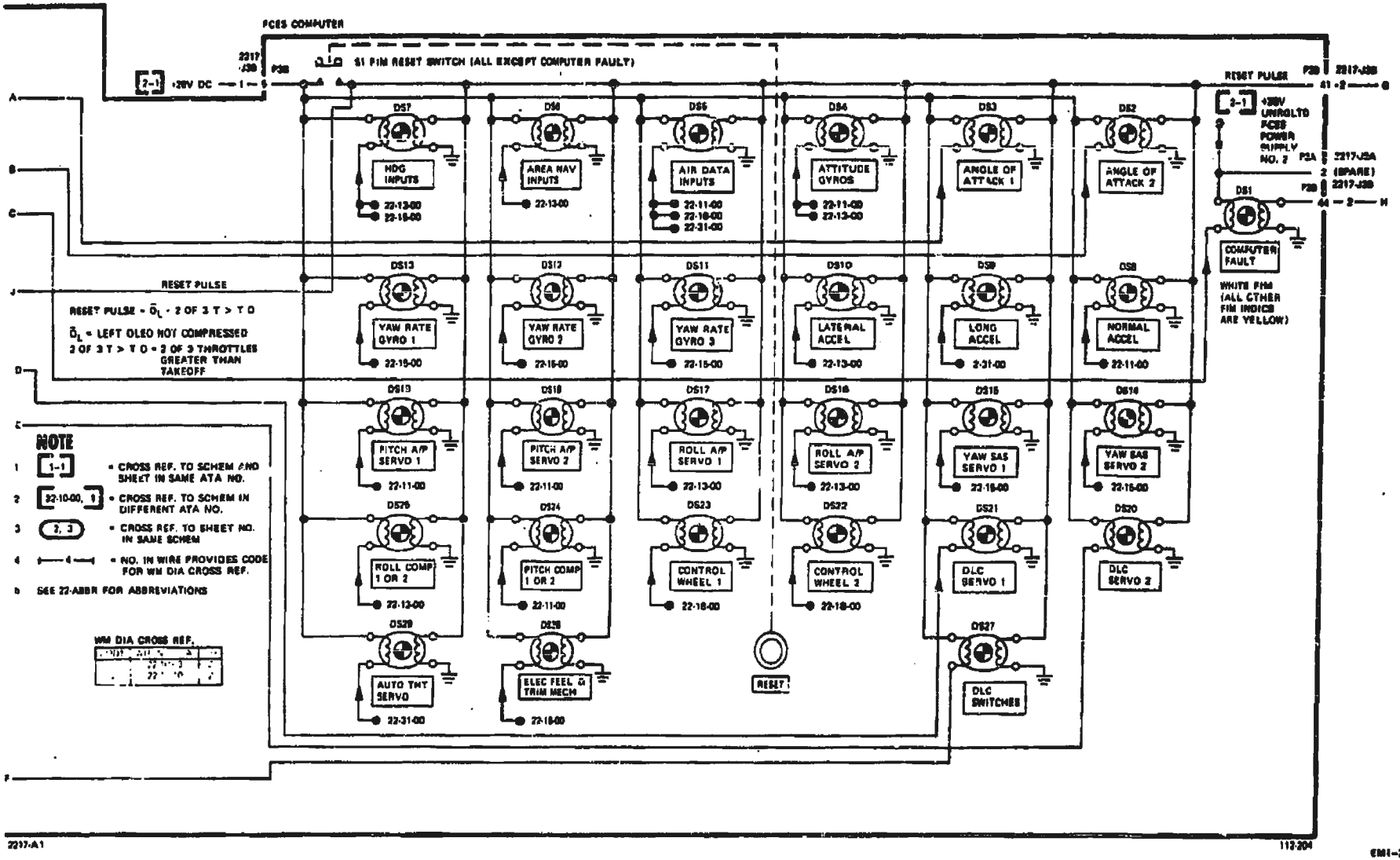
CODE	WIRING DIA.	SH
3	22-17-11	



R FCES FIM
R SCHEM 13 (Sheet 1)

EFFECTIVITY: ALL

001B


FCES COMPUTER
S1 FIM RESET SWITCH (ALL EXCEPT COMPUTER FAULT)
+28V DC
RESET PULSE
RESET PULSE = $\bar{O}_L$ · 2 OF 3 T > T O
$\bar{O}_L$ = LEFT OLEO NOT COMPRESSED
2 OF 3 T > T O = 2 OF 3 THROTTLES GREATER THAN TAKEOFF
HDG INPUTS
AREA NAV INPUTS
AIR DATA INPUTS
ATTITUDE GYROS
ANGLE OF ATTACK 1
ANGLE OF ATTACK 2
YAW RATE GYRO 1
YAW RATE GYRO 2
YAW RATE GYRO 3
LATERAL ACCEL
LONG ACCEL
NORMAL ACCEL
PITCH A/P SERVO 1
PITCH A/P SERVO 2
ROLL A/P SERVO 1
ROLL A/P SERVO 2
YAW SAS SERVO 1
YAW SAS SERVO 2
ROLL COMP 1 OR 2
PITCH COMP 1 OR 2
CONTROL WHEEL 1
CONTROL WHEEL 2
DLC SERVO 1
DLC SERVO 2
AUTO TNT SERVO
ELEC FEEL & TRIM MECH
DLC SWITCHES
RESET
COMPUTER FAULT
WHITE FIM (ALL OTHER FIM INDICS ARE YELLOW)
RESET PULSE
+28V UNREGLTD FCES POWER SUPPLY NO. 2
2 (SPARE)
NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [32-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS
WM DIA CROSS REF.
2217-A1
112-204

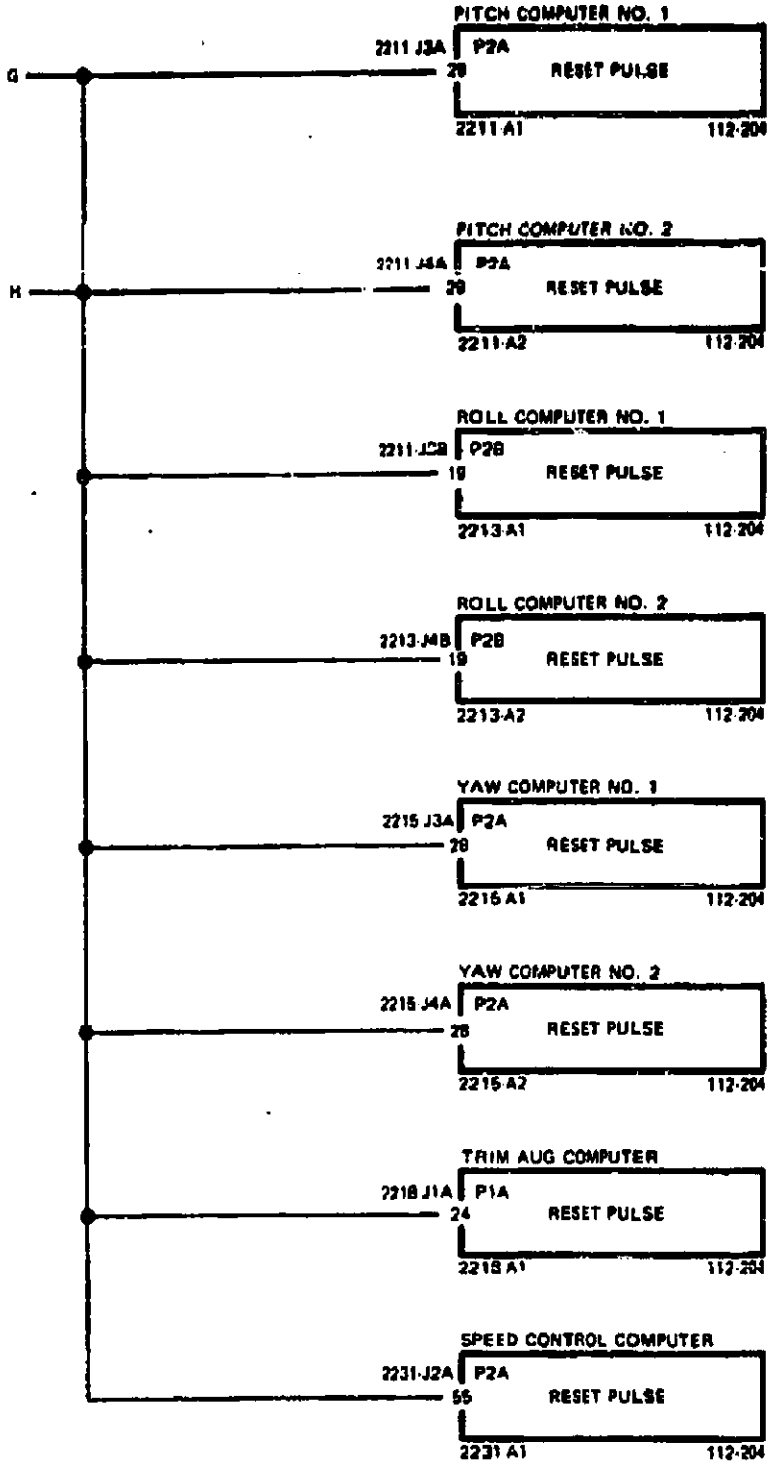
EM1-2000-22-1704

R
R

FCES FIM
SCHEM 13 (Sheet 2)

EFFECTIVITY: ALL

0018



EM1-C0000-22-1705

R FCES FIM
R SCHEM 13 (Sheet 3)

EFFECTIVITY: ALL

001B

R FLIGHT CONTROL ELECTRONICS SYSTEM (FCES) - MAINTENANCE PRACTICES

R 1. Maintenance Procedures - AGSB

R A. General

R One or both channels of the AGSB may be inoperative.

R B. Maintenance

R (1) Placard the flight station "AUTO GND SPLRS INOP".

R (2) Make appropriate entry in aircraft log book.

FLIGHT CONTROL ELECTRONIC SYSTEM - ADJUSTMENT AND TEST

1. General

R The Flight Control Electronic System (FCES) adjustment and test is comprised of the following test procedures:

A. FCES Test

B. APFDS Hydraulic System "C" Monitor Test

2. Equipment and Materials

Rig Pin 5/16-inch diameter by 3 inches long (R3), Part of B735 Wing Control Surface Rig Pin Kit

3. Referenced Procedures

21-00-00	Air Conditioning - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
27-11-00	Aileron Control System - Adjustment and Test
27-61-00	Spoiler and Speedbrake Control System - Adjustment and Test
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-00	Ram Air Turbine - Maintenance Practices
32-63-00	Air/Ground Sensing System - Maintenance Practices
34-14-00	Central Air Data Computer System - Maintenance Practices

4. FCES Test

R R The FCES operational test provided below requires that all auto flight system components and associated equipment are installed and operational. The operational test is broken down into the following FCES functions:

Stall warning

PFCS monitoring

Direct lift control (DLC)/automatic ground speedbrake (AGSB)

Altitude alert

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

NOTE: Hydraulic power is required only when performing PFCS monitoring, DLC/AGSB, and trim and feel operation tests.

R (4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

All circuit breakers on AVIONICS FLIGHT CONTROL SYSTEM strips

26 VAC NAV EXCITATION

ALT ALERT-1 (K27)

ALT ALERT-2 (J21)

R On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

FLIGHT STATION MISC

R AOA (F1)

STICK SHAKE (F2)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

WARNING: VERIFY THAT STEPS (5) THROUGH (7) HAVE BEEN PERFORMED BEFORE THE THROTTLE LEVERS ARE MOVED TO THE REVERSE THRUST POSITION.

R R (5) On pilots overhead circuit breaker panel CB1, zone 213, open the following circuit breakers:

THRUST REVERSE

ENG 1 (H16)

ENG 2 (H17)

ENG 3 (H18)

(6) On FE/SO ENGINE BLEED CONTROL panel, depress three ENG ISLN VALVE switchlights and three HI PRESS valve switchlights to OFF.

RESULTS:

Verify that switchlights indicate OFF, and flow bars are dark.

(7) Verify that thrust reversers on each engine are clear of personnel and equipment before proceeding.

B. Stall Warning Operational Test

(1) On FCES control panel, depress STALL WARN 1 and 2 switchlights to on, and DLC/AUTO SPLR switchlights to OFF.

(2) Depress STALL WARN 2 switchlight to OFF.

(3) Depress and hold STALL WARN TEST switch. Verify that both control columns vibrate.

(4) Release STALL WARN TEST switch.

(5) Depress STALL WARN 2 switchlight to on and release STALL WARN 1 switchlight to OFF.

(6) Depress and hold STALL WARN TEST switch. Verify that both control columns vibrate.

(7) Release STALL WARN TEST switch.

(8) Depress STALL WARN 1 switchlight to on.

(9) Depress and hold STALL WARN TEST switch. Verify that both control columns vibrate.

(10) Release STALL WARN TEST switch.

C. PFCS Monitoring Operational Test

(1) On PFCS monitor/control panel, verify that all switchlights are on (latched in) with no legends annunciated.

(2) Check PFCS roll axis monitor and control operation as follows:

(a) In forward electronic service center, install rig pin R3 through bracket and Captains roll torque limiter (aileron neutral position) to lock aileron controls (Ref. 27-11-00).

(b) On PFCS monitor control panel, depress PFCS MONITOR ROLL 2 switchlight to OFF.

(c) Turn Captains control wheel with a force of approximately 40 pounds. Verify the following on PFCS monitor/control panel:

Striped half of AILERON L OUTBD and L INBD switchlights come on.

PUSH legend on SPOILER L & R4 and L5 & 6 switchlights come on.

PULL ROLL DISC indicator comes on.

(d) Release control wheel.

R R R (e) On PFCS monitor control panel, depress all illuminated PUSH and cross hatched legends on PFCS panel. All legends in Step C(2)(c) go off.

(f) In forward electronic service center, remove rig pin R3 from Captains roll torque limiter.

(g) Install rig pin R3 through bracket and First Officers roll torque limiter (aileron neutral position) to lock aileron controls (Ref. 27-11-00).

(h) On PFCS monitor control panel, depress ROLL 2 switchlight to on.

(i) Turn First Officers control wheel with a force of approximately 40 pounds. Verify following on PFCS monitor/control panel:

Striped half of AILERON R OUTBD and R INBD switchlights come on.

PUSH legend on SPOILER L & R2, L & R3, and R5 & 6 switchlights come on.

PULL ROLL DISC indicator comes on.

(j) Release control wheel.

R R R (k) On PFCS monitor control panel, depress all illuminated PUSH and cross hatched legends on PFCS panel. All legends in Step C(2)(i) go off.

(l) In forward electronic service center, remove rig pin R3 from First Officers roll torque limiter.

(3) Check PFCS pitch axis monitor and control operations as follows:

(a) On pilots center console, pull and lock PITCH DISC handle.

(b) Release STABILIZER A and B switchlights. Verify the following:

INOP legend on STABILIZER A and B switchlights comes on.

FLT CONT PANELS light on pilots caution and warning panel flashed.

AFT CPLR OPEN indicator comes on.

No stabilizer movement using Captains control column.

Normal stabilizer movement using First Officers control column.

(c) Depress STABILIZER A switchlight. Verify the following:

INOP legend on STABILIZER A switchlight goes off.

(d) Depress STABILIZER B switchlight to turn off INOP legend. Verify that FLT CONT PANELS light on

pilots caution and warning panel goes off. Verify that AFT CPLR OPEN indicator goes off.

R (e) Release STABILIZER C and D switchlights. Verify
R the following:

INOP legend on STABILIZER C and D switchlights comes on.

FLT CONT PANELS light on pilots caution and warning panel flashed.

AFT CPLR OPEN indicator comes on.

No stabilizer movement using First Officers control column.

Normal stabilizer movement using Captains control column.

(f) On pilots center console, release and push in PITCH DISC handle.

R (g) Depress STABILIZER C and D switchlights. Verify
R the following:

FLT CONT PANELS light on pilots caution and warning panel goes off.

INOP legend on STABILIZER C and D switchlights goes off.

AFT CPLR OPEN indicator goes off.

D. DLC/AGSB Operational Test

(1) On pilots overhead circuit breaker panel CB1, open and tag MISC RAT AUTO DEPLOY (L3) circuit breaker.

(2) Install rat ground safety lock (Ref. 29-21-00).

(3) On FCES control panel, depress DLC/AUTO SPLR 1 and 2 to on, and STALL WARN 1 and 2 switchlights to OFF.

WARNING: ENSURE THAT TRAVEL AREAS OF SLAT, FLAP, AND SPOILER SURFACES, AND THRUST REVERSERS ON EACH ENGINE, AND AUTOTHROTTLE CLUTCH ASSEMBLY AREA ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(a) Ensure that all hydraulic systems are on.

(4) On pilots overhead panel, depress WARNING CAUTION ADVISORY TEST switch to ON, and then off.

RESULT:

After approximately 15 seconds, AUTO GND SPLRS INOP light goes off. If it remains on, perform following steps:

(a) If flaps are greater than 30 degrees, raise flaps to less than 30 degrees.

(b) On FCES panel, cycle DLC/AUTO SPLR 1 and 2 switchlights to OFF and then on.

(5) Depress DLC/AUTO SPLR 1 and 2 to OFF.

RESULT:

AUTO GND SPLRS INOP light flashes.

(6) Set flaps to 22 degrees. Verify that flaps move to 22 degrees.

(7) Depress DLC/AUTO SPLR 1 switchlight to on.

RESULT:

R AUTO GND SPLRS INOP light goes off.

(8) Set throttle lever No. 1 to reverse thrust. No ground spoiler deployment is indicated on surface position indicator (SPI).

(9) Set throttle lever No. 2 to reverse thrust. Ground spoiler deployment is indicated on SPI.

RESULT:

When checking channel 1, spoilers 1, 2, 3, 4 L and R fully deploy and speedbrake lever travels full stroke.

When checking channel 2, spoilers 2, 3, 4 L and R fully deploy. Spoilers 1 L and R deploy approximately 50 degrees and speedbrake lever travels approximately 1 to 1.5 inches less than full stroke.

Rate of speedbrake lever travel at start of movement under both conditions is approximately

R the same. Channel 2 lever travel rate is slower during the last portion of lever motion.

(10) Set throttle lever No. 1 to idle. Spoiler retraction is indicated on SPI.

(11) Set throttle lever No. 3 to reverse thrust. Ground spoiler deployment is indicated on SPI.

(12) Set throttle lever No. 2 to idle. Spoiler retraction is indicated on SPI.

(13) Set throttle lever No. 1 to reverse thrust. Ground spoiler deployment is indicated on SPI.

(14) Return throttle levers No. 1 and 3 to idle. Spoiler retraction is indicated on SPI.

(15) Extend flaps more than 30 degrees. Spoiler deployment is indicated on SPI.

(16) Return flaps to less than 30 degrees. Spoiler retraction is indicated on SPI.

(17) Depress DLC/AUTO SPLR 1 switchlight to OFF, and DLC/AUTO SPLR 2 switchlight to on.

R (18) Repeat Steps (8) through (16) to check Channel 2
R operation.

(19) Depress DLC/AUTO SPLR 2 switchlight to OFF.

RESULT:

AUTO GND SPLRS INOP light flashes.

(20) Place aluminum shims in all oleo proximity sensors (nose gear and both main landing gears) to simulate airborne condition (Ref. 32-63-00).

(21) Depress DLC/AUTO SPLR 1 switchlight to on.

RESULT:

AUTO GND SPLRS INOP light goes off.

(22) Extend flaps more than 30 degrees. Spoilers deploy to DLC neutral (-7 degrees).

(23) Move either control column as follows:

(a) Full forward and hold.

RESULT:

Spoiler moves to DLC maximum, then DLC neutral.

(b) Return to Center.

RESULT:

Spoiler moves to DLC zero, then DLC neutral.

(c) Full aft and hold.

RESULT:

Spoiler moves to DLC zero, then DLC neutral.

(d) Return to Center.

RESULT:

Spoiler moves to DLC maximum, then DLC neutral.

(24) Set throttle lever No. 1 full forward. Spoilers remain deployed to DLC neutral.

(25) Set throttle lever No. 2 full forward. Spoilers retract.

(26) Set throttle lever No. 1 to idle. Spoilers deploy to DLC neutral.

(27) Set throttle lever No. 3 full forward. Spoilers retract.

(28) Set throttle lever No. 2 to idle. Spoilers deploy to DLC neutral.

(29) Set throttle lever No. 1 full forward. Spoilers retract.

(30) Return throttle levers No. 1 and 3 to idle. Spoilers deploy to DLC neutral.

(31) Depress DLC/AUTO SPLR 1 switchlight to OFF.

RESULT:

AUTO GND SPLRS INOP light flashes.

(32) R Place steel shims in both truck sensors of left main landing gear (Ref. 32-61-08).

(33) R Place steel shims in both truck sensors of right main landing gear (Ref. 32-61-08).

(34) Depress DLC/AUTO SPLR 1 switchlight to on. Spoilers deploy to maximum spoiler position as indicated by speedbrake lever and AUTO GND SPLRS INOP light goes off.

(35) Remove steel shims from both main landing gear truck sensors.

RESULT:

Spoilers remain at maximum spoiler position. Wait 15 seconds, AUTO SPLR INOP light not on.

(36) Set flaps to 22 degrees and then back to 33 degrees.

RESULT:

Spoilers return to zero and to DLC neutral. DLC/AUTO SPLR switchlight does not indicate FAIL.

(37) Depress DLC/AUTO SPLR 1 switchlight to OFF, and DLC/AUTO SPLR 2 switchlight to on.

(38) Repeat Steps (22) through (36). In Steps (31) and (34) use DLC/AUTO SPLR 2 switchlight in place of DLC/AUTO SPLR 1 switchlight.

(39) Perform throttle lever reset of truck tilt as follows:

(a) Depress DLC/AUTO SPLR 2 switchlight to OFF.

RESULT:

AUTO GND SPLRS INOP light flashes.

(b) Set all three throttle levers to full forward and return to flight idle position.

(c) R Place steel shims in both truck sensors on right main landing gear (Ref. 32-61-08).

(d) R Place steel shims in both truck sensors on left main landing gear (Ref. 32-61-08).

(e) Depress DLC/AUTO SPLR 1 switchlight to on. Spoilers deploy to maximum spoiler position as indicated by speedbrake lever.

RESULT:

AUTO GND SPLRS INOP light goes out.

(f) Remove both steel shims from both right landing gear truck sensors.

(g) Set all three throttle levers to full forward and return to flight idle position within 6 seconds. Spoilers return to zero and then to DLC maximum (-16 degrees). After a short delay, AUTO GND SPLRS INOP light flashes and spoilers return to DLC neutral.

(h) Depress DLC/AUTO SPLR 1 switchlight to OFF.

(i) Place steel shims in both truck sensors on right main landing gear.

(j) Depress DLC/AUTO SPLR 2 switchlight to on. Spoilers deploy to maximum spoiler position as indicated by speedbrake lever.

RESULT:

AUTO GND SPLRS INOP light goes out.

(k) Remove both steel shims from left main landing gear truck sensors.

(l) Set all three throttle levers to full forward and return to flight idle position within 6 seconds. Spoilers return to zero and then to DLC maximum. After a short delay, AUTO GND SPLRS INOP light flashes, and spoilers return to DLC neutral.

(40) Depress DLC/AUTO SPLR 2 switchlight to OFF.

(41) Remove aluminum shims from all oleo proximity sensors (nose gear and both main landing gears). Remove both steel shims from right main landing gear truck sensors (Ref. 32-63-00). Aircraft is now in on-ground condition.

(42) Set all three throttle levers to full forward and return to flight idle position within 6 seconds. Depress DLC/AUTO SPLR 1 and 2 switchlights to on.

Spoilers deploy to maximum spoiler position and AUTO GND SPLRS INOP light goes out.

(43) Retract flaps to less than 30 degrees. Spoilers retract.

(44) On CB1, close the following circuit breakers:

THRUST REVERSE

ENG 1 (H16)

ENG 2 (H17)

ENG 3 (H18)

CAUTION: BE SURE ALL ARTIFICIAL TARGETS ARE REMOVED FROM AIR/GROUND SENSORS.

E. Altitude Alert Operational Test

(1) Verify that the central air data computer system is on (Ref. 34-14-00).

(2) Set Captains and First Officers barometric altimeters to local barometric pressure using BARO SET knob.

(3) On ALT SELECT panel, set NORM-STBY switch to NORM, and set ALTITUDE SELECT control knob for an altitude 2000 feet above Captains barometric altimeter indication.

(4) On APFDS ENGAGE panel, set FD A and FD B switches to ON. Both Attitude Director Indicator (ADI) command bars come into view and indicate level flight.

(5) On ALT SELECT panel, depress ARM switchlight to turn on ARM light. On both AFCS MODES annunciators, ALT ARM indication is displayed.

(6) On ALT SELECT panel, depress and hold TEST switch through Step E(10).

(7) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until both APPROACH alert indicators come on. APPROACH alert indicators should come on at 1000 (±100) feet above Captains barometric altimeter indication.

(8) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until a 0.5-second audio tone is heard, both APPROACH alert indicators go out, and ALTITUDE alert indicators come on. The 0.5-second

audio tone is heard at 500 (±100) feet above Captains barometric altimeter indication when approaching altitude. The APPROACH indicators go off, and the ALTITUDE indicators come on at 250 (±100) feet above Captains barometric altimeter indication.

(9) Using ALTITUDE SELECT CONTROL knob, slowly decrease selected altitude until ALT ARM messages are removed and ALT messages are displayed on AFCS MODES annunciators. ALT light on HEADING/PITCH MODE panel comes on, and ARM light on ALT SELECT panel goes off. Command bars on ADI should indicate level flight. Above actions occur at Captains barometric altimeter indication plus or minus 100 feet.

(10) Using ALTITUDE SELECT control knob, slowly increase selected altitude until a 0.5-second audio tone is heard. Tone should be heard at 250 (±100) feet above Captains barometric altimeter indication.

Continue to increase altitude until ALTITUDE alert indicators go off and DEVIATION alert indicators flash. This action should occur at 500 (±100) feet above Captains barometric altimeter indication.

(11) Release TEST switch.

(12) On HEADING/PITCH MODE panel, depress ALT switchlight to off.

(13) Rotate ALTITUDE SELECT control knob. ALTITUDE alert indicators go off when knob is rotated.

(14) On ALT SELECT panel, set NORM-STBY switch to STBY, and set ALTITUDE SELECT control knob for an altitude 2000 feet above First Officers barometric altimeter indication.

(15) On ALT SELECT panel, depress ARM switchlight to turn on ARM light. On both AFCS MODES annunciators, ALT ARM indication is displayed.

(16) On ALT SELECT panel, depress and hold TEST switch through Step E(20).

(17) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until both APPROACH alert indicators come on. APPROACH alert indicators should come on at 1000 (±100) feet above First Officers barometric altimeter indication.

(18) Using ALTITUDE SELECT control knobs slowly decrease selected altitude until a 0.5-second audio tone is heard, both APPROACH alert indicator, go out, and ALTITUDE alert indicators come on. The 0.5-second audio-tone is heard at 500 (±100) feet above First Officers barometric altimeter indication when approaching altitude. The APPROACH indicators go off, and the ALTITUDE indicators come on at 250 (±100) feet above First Officers barometric altimeter indication.

(19) Using ALTITUDE SELECT control knob, slowly decrease selected altitude until ALT ARM messages are removed and ALT messages are displayed on AFCS MODES annunciators. ALT light on HEADING/PITCH MODE panel comes on, and ARM light on ALT SELECT panel goes off. Command bars on ADI should indicate level flight. The above indications occur at First Officers barometric altimeter indication plus or minus 100 feet.

(20) Using ALTITUDE SELECT control knob, slowly increase selected altitude until a 0.5-second audio tone is heard. Tone should be heard at 250 (±100) feet above First Officers barometric altimeter indication.

Continue to increase altitude until ALTITUDE alert indicators go off and DEVIATION alert indicators flash. This action should occur at 500 (±100) feet above First Officers barometric altimeter indication.

(21) Release Test switch.

(22) Depress ALT switchlight to off.

(23) Using ALTITUDE SELECT control knob, increase altitude until ALTITUDE alert indicator goes out.

(24) Set FD A and FD B switches to OFF.

F. Test Completion

(1) Remove rat ground safety lock (Ref. 29-21-00).

(2) On pilots overhead circuit breaker panel CB1, remove tag and close MISC RAT AUTO DEPLOY (L3) circuit breaker.

(3) Turn off hydraulic power (Ref. 29-11-00).

(4) Turn off electrical power (Ref. 24-00-00).

CAUTION: BE SURE ALL ARTIFICIAL TARGETS ARE REMOVED FROM AIR/GROUND SENSORS.

5. Operational Check, Hydraulic System "C" Monitor Test

R The operational check, hydraulic system "C" monitor test provided below requires that all other auto flight system components and associated equipment are installed and operational. This includes weight on wheels signal (NLG and MLG), and truck level signal.

A. Operational Check

(1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that avionics cooling is on (Ref. 21-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on all hydraulic system power (Ref. 29-11-00).

(4) On pilots overhead circuit breaker panel CB1, zone 213, verify that following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

FCES - COMPUTERS - DC (B4)

FCES - COMPUTERS - AC & L AOA (B5)

LANDING GEAR - PROX SW PWR - NO. 1 (L10)

LANDING GEAR - PROX SW PWR - NO. 4 (L11)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 214, verify that following circuit breakers are closed:

GROUND SERVICE - MLG GND SENSE (L8)

HYDRAULIC - AFCS WARNING - CAPT (K18)

HYDRAULIC - AFCS WARNING - F/O (K19)

HYDRAULIC - DLC SERVO - A (H14)

HYDRAULIC - DLC SERVO - B (H15)

GEAR - TRUCK LEVEL (F16)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that following circuit breakers are closed:

PROXIMITY SWITCH - 2 (H3)

PROXIMITY SWITCH - 3 (H4)

(5) On FCES control panel, depress DLC/AUTO SPLR 1 and 2 switchlights to OFF.

(6) Move flap handle to 22-degrees flap position.

(7) Place all throttle levers to idle thrust position.

(8) Ensure that LANDING GEAR control lever is in DOWN position.

R (9) Ensure two amber lights on speedbrake handle switch are
R off. If not, press speedbrake handle switch once to
R turn them off .

(10) On FCES control panel, depress DLC/AUTO SPLR 1 switchlight to on. Wait 15 seconds. AUTO GND SPLR INOP light shall not come on.

(11) Turn off hydraulic system "C" (Ref. 29-11-00). Verify that AUTO GND SPLR INOP light on caution and warning indicator flashes.

(12) Wait 15 seconds, then turn on hydraulic system "C" (Ref. 29-11-00).

(13) The AUTO GND SPLR INOP light shall automatically go out.

(14) On FCES control panel, depress DLC/AUTO SPLR 1 switchlight to OFF and DLC/AUTO SPLR 2 switchlight to on. Wait 15 seconds. AUTO GND SPLR INOP light shall not come on.

(15) Turn off hydraulic system "C". Verify that AUTO GND SPLR INOP light flashes.

(16) Wait 15 seconds, then turn on hydraulic system "C".

(17) AUTO GND SPLR INOP light shall automatically go out.

(18) Depress DLC/AUTO SPLR 1 switchlight to on.

(19) Turn off hydraulic power (Ref. 29-11-00).

(20) Turn off electrical power (Ref. 24-00-00).

FCES COMPUTER - REMOVAL AND INSTALLATION

1. Referenced Procedure

   29-11-00 Hydraulic Power System - Maintenance Practice

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

      AVIONICS FLIGHT CONTROL SYSTEM - FCES - COMPUTERS - AC & L AOA (B5)

      AVIONICS FLIGHT CONTROL SYSTEM - FCES - COMPUTERS - DC (B4)

      26 VAC NAV EXCITATION - ALT ALERT-1 (K27)

      26 VAC NAV EXCITATION - ALT ALERT-2 (J21)

      On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker FLIGHT STATION MISC - R AOA (F1).

      (2) Open access door 112AB and enter forward electronic service center, zone 112. Locate FCES computer in center rack (Ref. Fig. 401).

      (3) Release holddowns on computer front panel.

      (4) Pull computer handle to release computer electrical connectors from mount connectors.

      (5) Slide computer out of mount.

   B. Installation

      (1) Verify that circuit breakers opened in Steps A(1) are open and tagged.

      (2) Slide FCES computer (Ref. Fig. 401) into mount until computer electrical connectors mate with mount connectors.

      (3) Secure computer with holddowns.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Perform operational test in Step C.

C. Operational Test

(1) Preparation

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(a) Turn on hydraulic systems A, B, C and D (Reference 29-11-00).

(b) Set flaps to less than 27 degrees.

WARNING: VERIFY THAT STEPS (c) THROUGH (e) HAVE BEEN PERFORMED BEFORE THE THROTTLE LEVERS ARE MOVED TO THE REVERSE THRUST POSITION.

(c) On pilots overhead circuit breaker panel CB1, zone 213, open the following circuit breakers:

THRUST REVERSE

ENG 1 (H16)

ENG 2 (H17)

ENG 3 (H18)

R (d) On FE/SO ENGINE BLEED CONTROL panel, depress three
R ENG ISLN VALVE switchlights and three HI PRESS
R valve switchlights to OFF.

R RESULT:

R Verify that the switchlights indicate OFF, and
R flow bars are dark.

(e) Verify that thrust reversers on each engine are clear of personnel and equipment before proceeding.

CR CR (f) Verify that the lights on top of the speed brake lever are off.

(2) PFCS Monitoring Test

NOTE: In the following Steps (2)(a) and (2)(b), STABILIZER C and D can be A and B instead, but not all four at the same time.

(a) On PFCS MONITOR panel, release all switchlights except RUDDER and STABILIZER C and D.

RESULT:

INOP or OFF lights come on in released position.

(b) On PFCS MONITOR panel, depress all switchlights except RUDDER and STABILIZER C and D.

RESULT:

INOP and OFF lights go out.

(3) Stall Warning Test

(a) On FCES panel, depress STALL WARN 1 and 2 switchlights to on, and depress DLC/AUTO SPLR 1 and 2 switchlights to OFF.

RESULT:

STALL WARN legends dark, and DLC/AUTO SPLR legends to OFF.

(b) Depress STALL WARN 2 switchlight to OFF.

(c) On FCES panel, depress and hold STALL WARN TEST switch for approximately 5 seconds.

RESULT:

Control columns shake, and no STALL WARN 1 FAIL legend when switch is depressed. Control columns stop shaking when switch is released.

(d) Depress STALL WARN 1 switchlight to OFF and STALL WARN 2 switchlight to on.

(e) Repeat Step (c) for system No. 2.

R (f) Depress STALL WARN 2 switchlight to OFF.

(4) DLC/AGSB Test

C WARNING: ENSURE THAT TRAVEL AREAS OF SLAT, FLAP,
C SPOILER SURFACES, THRUST REVERSERS ON EACH
C ENGINE, AND THE AUTOTHROTTLE CLUTCH AREA ARE
C CLEAR OF PERSONNEL AND GROUND EQUIPMENT
C BEFORE PROCEEDING.

(a) On FCES panel, depress DLC/AUTO SPLR 1 and 2 switchlights to on (dark).

RESULT:

On CAWP, AUTO GND SPLRS INOP light is out within 15 seconds.

(b) Set throttle lever No. 1 to reverse thrust.

RESULT:

C No ground spoiler deployment is indicated by
C speed brake lever.

(c) Set throttle lever No. 2 to reverse thrust.

RESULT:

C Ground spoiler deployment as indicated by
C speed brake lever.

(d) Set throttle lever No. 1 to idle.

RESULT:

C Spoiler retraction as indicated by speed brake
C lever.

(e) Set throttle lever No. 3 to reverse thrust.

RESULT:

C Ground spoiler deployment as indicated by
C speed brake lever.

(f) Set throttle lever No. 2 to idle.

RESULT:

C C Spoiler retraction as indicated by speed brake lever.

(g) Set throttle lever No. 1 to reverse thrust.

RESULT:

C C Ground spoiler deployment as indicated by speed brake lever.

(h) Return throttle levers 1 and 3 to idle.

RESULT:

C C Spoiler retraction as indicated on speed brake lever.

(i) Extend flaps more than 30 degrees.

RESULT:

C C Spoiler deployment as indicated by speed brake lever.

(j) Retract flaps to less than 30 degrees.

RESULT:

C C Spoiler retraction as indicated by speed brake lever.

(5) Altitude Alert Test

(a) On ALT SELECT panel, set NORM - STBY switch to NORM, and set ALTITUDE SELECT control knob for an altitude 2000 feet above Captains barometric altimeter indication.

(b) On ALT SELECT panel, depress and hold TEST switch until directed in test to release switch.

(c) Using ALTITUDE SELECT control knob, slowly decrease selected altitude and observe the following result.

RESULT:

Both APPROACH alert indicators come on at 1000 (±100) feet above Captains barometric altimeter indication.

An audio tone is heard at 500 (±100) feet above Captains barometric altimeter indication when approaching altitude.

Both APPROACH indicators go out, and ALTITUDE indicators come on at 250 (±100) feet above Captains altimeter indication.

(d) Using ALTITUDE SELECT control knob, slowly increase selected barometric altitude and observe the following result.

RESULT:

Both ALTITUDE alert indicators go out and an audio tone is heard 250 (±100) feet above Captains barometric altimeter indiction.

Both DEVIATION alert indicators flash at 500 (±100) feet above Captains barometric altitude indication.

(e) Release TEST switch.

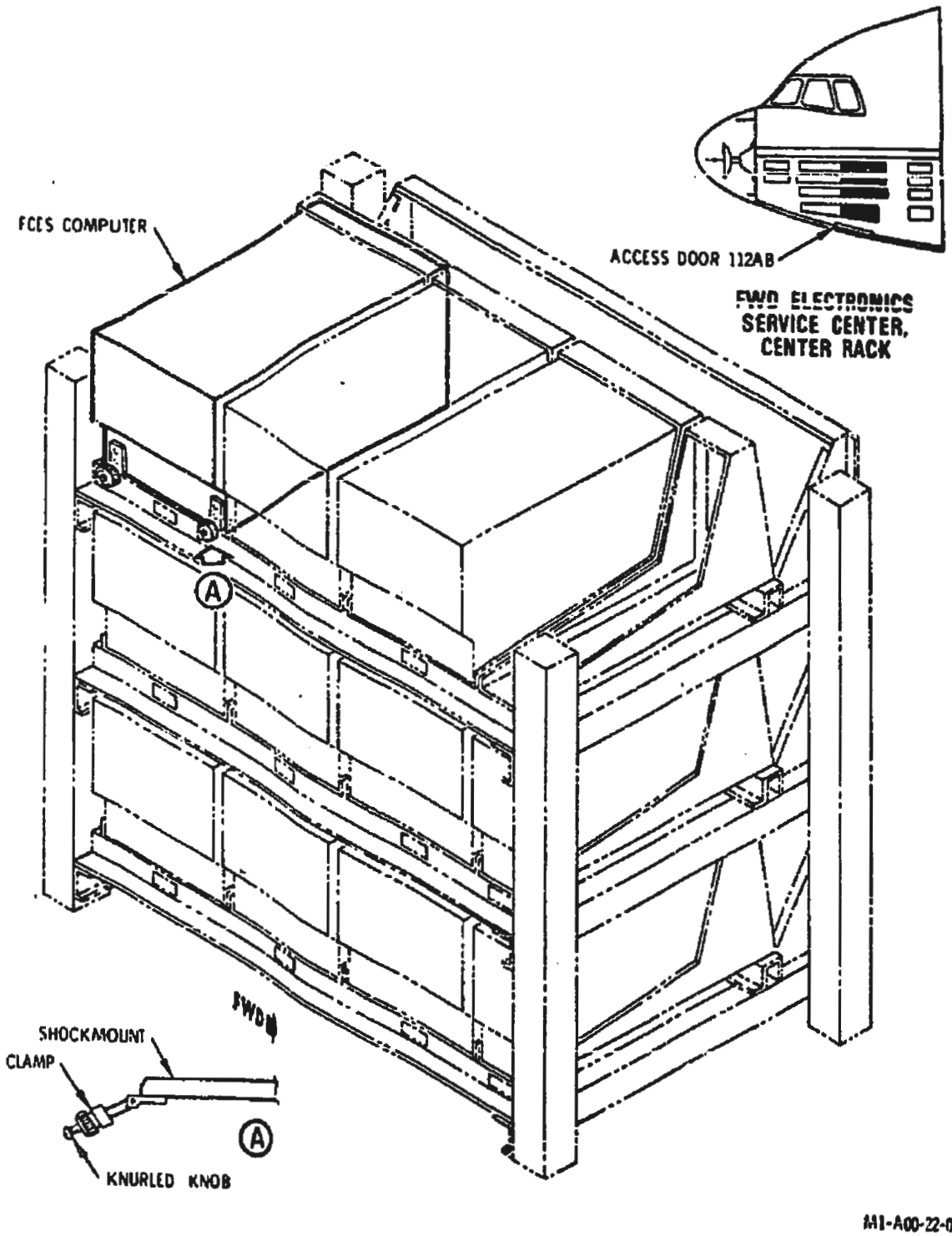
(f) On ALT SELECT panel, set NORM - STBY switch to STBY, and set ALTITUDE SELECT control knob for an altitude 2000 feet above First Officers barometric altimeter indication.

(g) Repeat Steps (b) through (e) for First Officers barometric altimeter.

(6) Completion

(a) On ALT SELECT panel, set NORM - STBY switch to NORM.

(b) Turn off hydraulic systems (Reference 29-11-00).



FCES Computer - Removal and Installation
Figure 401

PFCS MONITOR/CONTROL PANEL - MAINTENANCE PRACTICES

1. General

One PFCS monitor pitch channel may be inoperative provided:

The control switch of the inoperative channel is maintained in the off position.

R The Surface Position Indicator (SPI) is fully operative (See 27-00-01).

The jam and open cable detectors of the operative channel are verified by ground checkout prior to the first flight of each day.

2. Referenced Procedures

27-00-01	Surface Position Indicator - Adjustment and Test
27-41-06	Pitch Control Override Bungee and Aft Coupler - Adjustment and Test
27-41-32	Pitch Control Cable Breakage Detector - Adjustment and Test

3. Deactivation - PFCS Monitor

A. Deactivation of Inoperative Channel

NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

(1) On PFCS panel, depress failed PFCS MONITOR PITCH 1 or 2 switchlight to OFF.

R (2) Perform SPI adjustment and test (Ref. 27-00-01).

NOTE: When performing Steps (3) and (4) delete steps concerned with inoperative channel.

(3) Perform pitch control override bungee and aft coupler
CR adjustment and test of operative channel (Ref. 22-00-00
CR "PFCS Pitch Axis Monitoring Check" or 27-41-06) prior
CR to the first flight each day.

(4) Perform pitch control cable breakage detector adjustment and test of operative channel (Ref. 27-41-32) prior to the first flight each day.

(5) Placard flight station appropriate PFCS MONITOR CHANNEL INOPERATIVE.

(6) Make appropriate entry in aircraft log book.

PFCS MONITOR/CONTROL PANEL - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-17-02 PFCS Monitor/Control Panel - Adjustment and Test

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL
R SYSTEM - NO. 1 AFT COUPLER (B9) and NO. 2 AFT COUPLER
R (B27).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag the following circuit breakers:

STABILIZER SERVO

R L - B (H16)

R R - C (H17)

R L - A (H18)

R R - D (H19)

RUDDER SERVO

R A (K12)

R B(K13)

R C (K14)

SPOILER SERVO

R A - 2 - L (J15)

R B - 1, 4, 6 - L&R (J16)

R C - 3, 5 - L&R (J17)

R D - 2 R (J18)

AILERON SERVO

R C - INBD - L&R (J19)

R A - INBD & OUTBD - L (J20)

R B - INBD & OUTBD - L&R (J21)

R D - INBD & OUTBD R (J22)

(2) Support PFCS monitor/control panel on pilots overhead panel, zone 210, and release fasteners.

(3) Lower panel to disconnect electrical connectors, and remove panel.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Connect electrical connectors to PFCS monitor/control panel.

(3) Raise panel in position and secure.

(4) Remove tags and close circuit breakers opened in Step A(1).

R (5) Perform PFCS monitor/control panel adjustment and test
R (Ref. 22-17-02).

PFCS MONITOR/CONTROL PANEL - ADJUSTMENT AND TEST

1. Equipment and Materials

Rig Pin 5/16-inch diameter by 3 inches long (R3), part of B735 Wing Control Surface Rig Pin Kit

2. Referenced Procedures

R R	21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
	24-00-00	Electrical Power - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Adjustment/Test

The PFCS monitor/control panel operational test provided below requires that all other autoflight system components and associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that equipment cooling is on (Ref. 21-25-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

FCES - COMPUTERS - DC (B4)

FCES - COMPUTERS - AC & L AOA (B5)

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

RUDDER SERVO - A, B, and C (K12, 13, 14)

SPOILER SERVO - A, B, C, and D (J15, 16, 17, 18)

AILERON SERVO - C, A, B, and D (J19, 20, 21, 22)

STABILIZER SERVO - B, C, A, and D (H16, 17, 18, 19)

FLIGHT STATION MISC - R AOA (F1)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that IND LT - FLT CONT/ALT ALERT (G9) circuit breaker is closed.

(5) On PFCS monitor/control panel, verify that all switchlights are depressed (latched in) to on.

B. PFCS Roll Axis Monitor and Control Operational Test

(1) In forward electronic service center, install rig pin R3 through bracket and Captains torque limiter (aileron neutral position) to lock aileron controls (Ref. 27-11-00).

(2) On PFCS monitor control panel, depress PFCS MONITOR ROLL 2 switchlight to OFF.

(3) Turn Captains control wheel with a force of
R approximately 40 pounds to over ride jam. Verify the following on PFCS monitor/control panel:

Striped half of AILERON L OUTBD and L INBD switchlights come on.

PUSH legend on SPOILER L & R4 and L5 & 6 switchlights come on.

R FLT CONT PANEL legend (amber) on pilots CAWP comes on
R and flashes for 10 seconds, then remains on steady.

PULL ROLL DISC indicator comes on.

(4) Release control wheel.

R (5) Depress all illuminated PUSH and cross hatched legends
R on PFCS panel. PUSH and cross hatched legends go off.
R The corresponding OFF legends come on.

R (6) On PFCS monitor control panel, depress ROLL 1
R switchlight to OFF. PULL ROLL DISC legend will go off.

R (7) In forward electronic service center, remove rig pin R3
R from Captains torque limiter.

R (8) Install rig pin R3 through bracket and First Officers torque limiter (aileron neutral position) to lock aileron controls (Ref. 27-11-00).

R (9) On PFCS monitor control panel, depress ROLL 2
R switchlight to on.

R (10) Turn First Officers control wheel with a force of approximately 40 pounds. Verify the following on PFCS monitor/control panel:

Striped half of AILERON R OUTBD and R INBD switchlights come on.

PUSH legend on SPOILER L & R2, L & R3, and R5 & 6 switchlights come on.

R FLT CONT PANEL legend (amber) on pilots CAWP comes on
R and flashes for 10 seconds, then remains on steady.

PULL ROLL DISC indicator comes on.

R (11) Release control wheel.

R (12) Depress all illuminated PUSH and cross hatched legends
R on PFCS panel. PUSH and cross hatched legends to off.
R The corresponding OFF legends come on.

R (13) On PFCS monitor control panel, depress ROLL 2
R switchlight to OFF. PULL ROLL DISC legend goes off.

R (14) In forward electronic service center, remove rig pin R3 from First Officers torque limiter.

C. PFCS Pitch Axis Monitor and Control Operational Test

(1) On pilots center console, pull and lock PITCH DISC handle.

(2) Release STABILIZER A and B switchlights. Verify the following:

INOP legend on STABILIZER A and B switchlights comes on.

FLT CONT PANELS light on pilots caution and warning panel flashed.

AFT CPLR OPEN indicator comes on.

No stabilizer movement using Captains control column.

Normal stabilizer movement using First Officers control column.

(3) Depress STABILIZER A switchlight. Verify the following:

INOP legend on STABILIZER A switchlight goes out.

(4) Depress STABILIZER B switchlight to turn off INOP legend. Verify that FLT CONT PANELS light on pilots caution and warning panel goes off.

AFT CPLR OPEN indicator goes off.

(5) Depress STABILIZER C and D switchlights. Verify the following:

INOP legend on STABILIZER C and D switchlights comes on.

FLT CONT PANELS light on pilots caution and warning panel flashed.

AFT CPLR OPEN indicator comes on.

No stabilizer movement using First Officers control column.

Normal stabilizer movement using Captains control column.

(6) On pilots center console, release and push in PITCH DISC handle.

(7) Depress STABILIZER C and D switchlights. Verify the following:

FLT CONT PANELS light on pilots caution and warning panel goes out.

INOP legend on STABILIZER C and D switchlights goes off.

AFT CPLR OPEN indicator goes off.

D. Test Completion

(1) Turn off hydraulic power (Ref. 29-11-00).

(2) Turn off electrical power (Ref. 24-00-00).

FLAP LEVER POSITION SWITCH - REMOVAL AND INSTALLATION

1. General

The flap lever position switches, grouped and controlled by reel-type cams, are located aft of the flap lever control quadrant near the ceiling of the forward electronic service center, zone 112. The switches are identified with numbers. The switches functioning with the flight control electronics system are numbered 2, 3, 4, and 5.

The removal and installation procedure provided below applies to any one of the switches, however, opening of a circuit breaker before a switch removal differs as noted.

2. Referenced Procedures

20-24-02	Crimped Contact - Removal and Insertion
22-00-00	Auto Flight - Adjustment and Test
27-51-55	Flap Lever Actuated Switch - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL
R SYSTEM - FCES - COMPUTERS - AC & L AOA (B5) (For switch No. 2 or 3 removal only).

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit
R breaker FLIGHT STATION MISC - R AOA (FI) (for switch No. 4 or 5 removal only).

(2) Open access door 112AB.

R WARNING: ENSURE THAT FLAP CONTROL HANDLE IS NOT OPERATED DURING SWITCH REMOVAL.

(3) Release switch arm (for switch to be removed) from cam support assembly by removing screw, spring, and washer (Ref. Fig. 401).

(4) Rotate switch arm to provide access to switch attaching hardware.

(5) Remove screws, nuts, and washers to separate switch from switch arm.

NOTE: Switch actuator is attached with same hardware as switch, and comes off when switch is separated. Retain for reinstallation.

(6) Tag and disconnect wires from switch (Ref. 20-24-02).

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

R WARNING: ENSURE THAT FLAP CONTROL HANDLE IS NOT OPERATED DURING SWITCH INSTALLATION.

(2) Connect wires to switch (Ref. 20-24-02) and remove wire tags.

(3) Orient and position switch actuator, then the switch onto switch arm with mounting holes aligned (Ref. Fig. 401).

(4) Secure switch and switch actuator with screws, washers, and nuts.

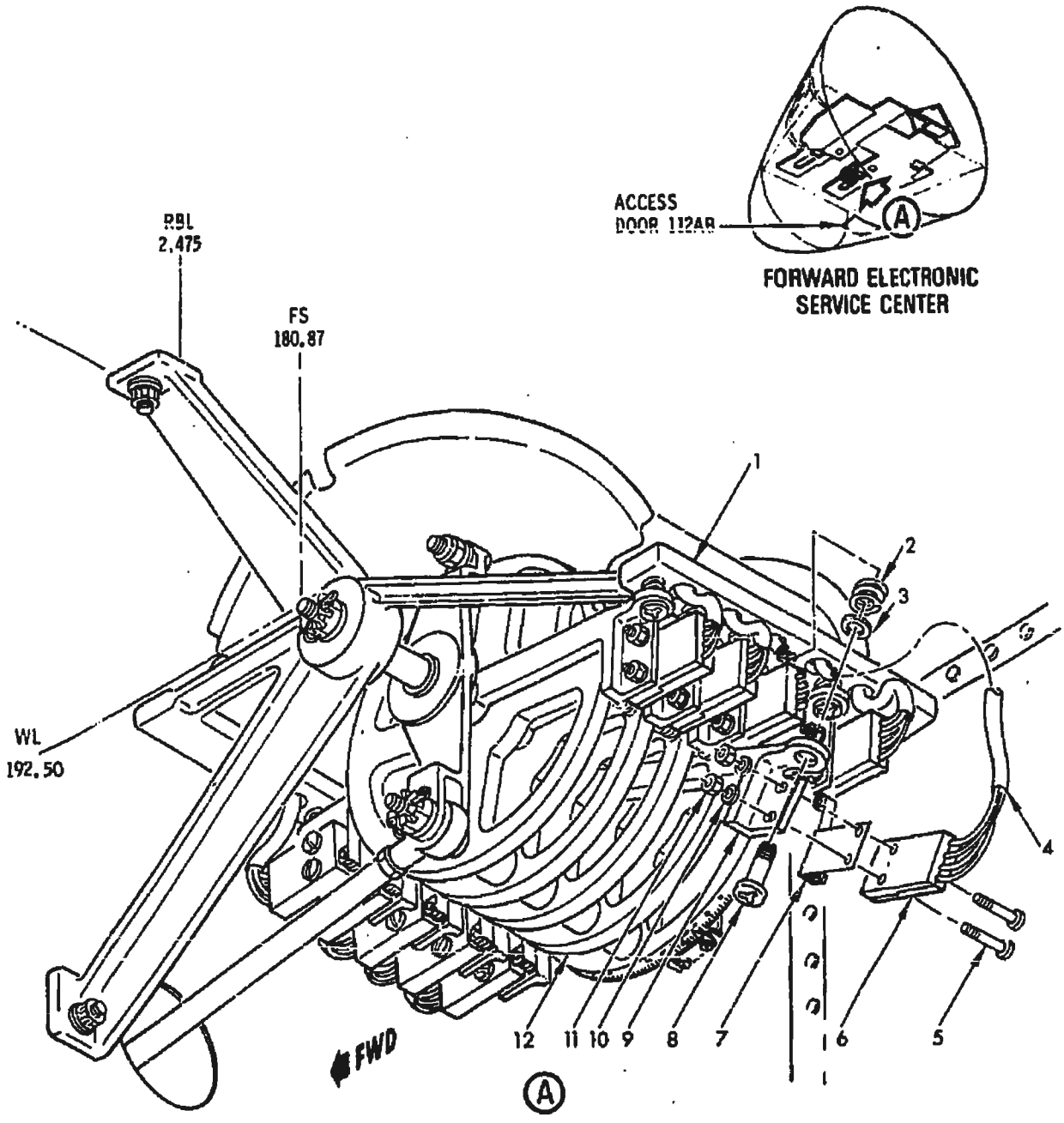
(5) Rotate switch arm back to cam support assembly and secure with screw, spring, and washer.

(6) Adjust switch (Ref. 27-51-55).

(7) Close access door.

(8) Remove tag and close circuit breaker opened in Step 3A(1).

(9) Perform DLC/AGS CHECK portion of AFCS General Check (Ref. 22-00-00, Table 501).



1	CAM SUPPORT ASSEMBLY	7	SWITCH ACTUATOR
2	SPRING	8	SCREW
3	WASHER	9	SWITCH ARM
4	INTERFACE WIRING	10	WASHER (2)
5	SCREW (2)	11	NUT (2)
6	FLAP LEVER POSITION SWITCH (TYP)	12	CAM (REF.)

HH 9977
M1-0100-22-055

R Flap Lever Position Switch - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R

STALL WARN SYSTEM - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting Stall Warn System faults are included in this section of the manual. A Stall Warn System malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use Stall Warn System Fault Matrix. Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the Stall Warn System fault isolation diagrams and schematics. Figure 101 and 102 provide component location for Stall Warn System troubleshooting.

A. General

Stall warn fault isolation contains two levels of troubleshooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph
R 2B) troubleshoots a specific stall warn problem. System
R oriented fault isolation (Ref. 22-17-05, Table 501) tests
R and troubleshoots the stall warn system.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the stall warn system by a specific fault number. It also identifies and locates the LRUs which can cause the problem. For faults not listed in
R Figure 103, perform System Oriented Fault Isolation in
R 22-17-05, Table 501 to isolate problem.

Figures 104, and 105 provide diagnostic steps to further isolate the fault. The diagnostic steps are in a flow chart

form which contains complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the actions are outside the blocks. When using the flow charts, it is assumed that systems are in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

Figure 106 is a schematic of the stall warn system.

Fault Isolation Diagrams and Schematic List
Table 101

	FIGURE	TITLE
	101	Component Locator Index
	102	Component Locator Diagram
	103	Stall Warn System Fault Matrix
	104	Stall Warn Test Faults
	105	Stall Warn Faults
R	SCHEM 1	Stall Warn Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCESSORY UNIT – AFCS/MLG	1	FESC, CTR RACK/112AB	22–10–11
COMPUTER – FLIGHT CONTROL ELECTRON ICS SYSTEM	1	FESC, CTR RACK/112AB	22–17–01
PANEL – FCES CONTROL	1	FLT STA, PILOTS OVHD PNL	22–10–07
SHAKER – STICK	2	FCES/112AB	22–17–16
SENSOR – ANGLE-OF-ATTACK	2	EXT, L & R/FS215	22–31–06
SWITCH BOX – SLAT POWER DRIVE UNIT	2	WING BUTT LEFT/511BT	27–81–08
SWITCH BOX – FLAP POWER DRIVE UNIT	2	HSC, ON FLAP PDU/147AB	27–51–12

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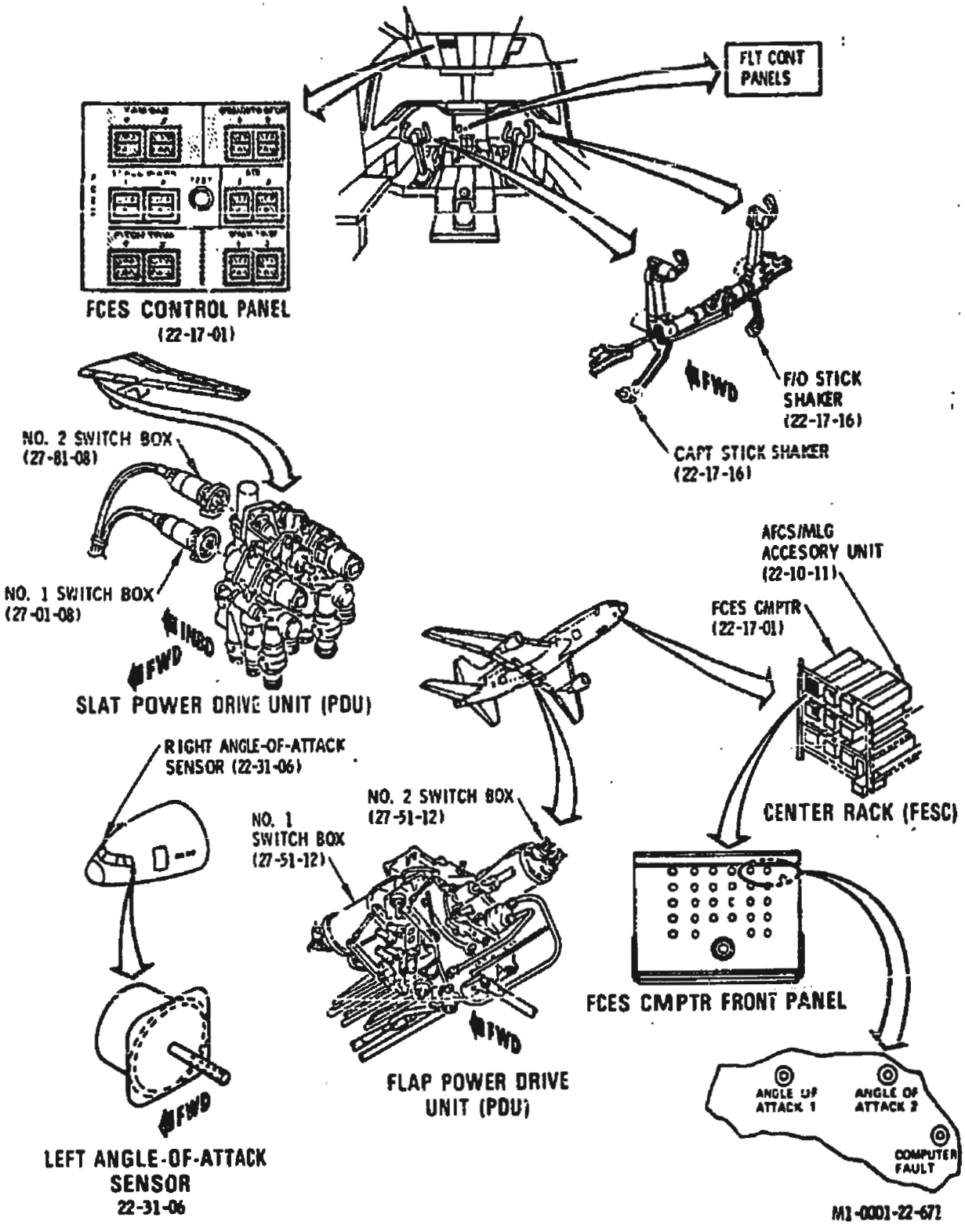
R
R Component Locator Index
Figure 101

EFFECTIVITY: ALL

001B



R
R

Component Locator Diagram
Figure 102

EFFECTIVITY: ALL

001B

← FAULTS →			← FIM →		← NO FIM →				
			Troubleshooting Faulty LRU						
No.	Problem		Check FIM on Front Panel of FCES Cmptr		Continuity Check or Replace				
			FC	AOA	FCES CP	FLSB	SLSB	AIR/ GND	SS
"STALL WARN TEST" FAULTS(Ref. Fig. 104)									
1	Stick shaker did not operate during dual channel test		X		X				2
2	STALL WARN 1 FAIL on during test, stick shaker ok. Sys 2 turned OFF.		X	1					
3	STALL WARN 2 FAIL on during test, stick shaker ok. Sys 1 turned OFF.		X	2					
4	Stick shaker did not operate during channel 1 stall warn test, FAIL light off. Sys 2 turned OFF.		X		X				1
5	Stick shaker did not operate during channel 2 stall warn test, FAIL light off. Sys 1 turned OFF.		X		X				2
6	STALL WARN 1 FAIL light on during test, stick shaker did not operate. Sys 2 turned OFF.		X	1				X	
7	STALL WARN 2 FAIL light on during test, stick shaker did not operate. Sys 1 turned OFF.		X	2				X	
"STALL WARN" FAULTS (Ref. Fig. 105)									
10	Stick shaker operates during rotation, STALL WARN FAIL light out. Fault isolated to STALL WARN system 1 by switching one system off at a time.			1		1	1		
11	Stick shaker operates during rotation, STALL WARN FAIL light out. Fault isolated to STALL WARN system 2 by switching one system off at a time.			2		2	2		
12	Stick shaker operates when flaps are extended, STALL WARN FAIL light out. Fault isolated to STALL WARN system off at a time.		X				1		
13	Stick shaker operates when flaps are extended, STALL WARN FAIL light out. Fault isolated to STALL WARN system 2 by switches one system off at a time.		X				2		
14	STALL WARN 1 FAIL light on, all other indications normal		X	1	X				
15	STALL WARN 2 FAIL light on, all other indicatons normal		X	2	X				
16	STALL WARN 1 FAIL and ATS 1 FAIL lights on			1					
17	STALL WARN 2 FAIL and ATS 2 FAIL lights on			2					
18	Both STALL WARN FAIL lights on, all other indications normal		X						
19	Stick shaker on for no apparant reason and ATS FAIL lights on. Fault 1 isolated to stall warning system 1(2). by switching one system off at a time.			1 2					
20	When flaps selected to 4 degrees on ground, STALL WARN 1 (2) FAIL light came on. System reset. OK on other flap selection.						1 2		

M1-0004-22-673

R
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Stall Warn System Fault Matrix
Figure 103 (Sheet 1)

EFFECTIVITY: ALL

0018

Abbreviations		Remove and Install Ref.	
		Chapt	Page
AIR/GRN	AFCS/MLG accessory unit	22-10-11	401
AOA	Angle of attack sensor	22-31-08	401
FC	FCES computer	22-17-01	401
FCES CP	FCES control panel	22-10-07	401
FL SB	Flap PDU switch box	27-51-12	401
SL SB	Slat PDU switch box	27-61-08	401
SS	Stick shaker	22-17-16	401

HOW TO USE

1. Find flight squawk in FAULTS Column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 or 105

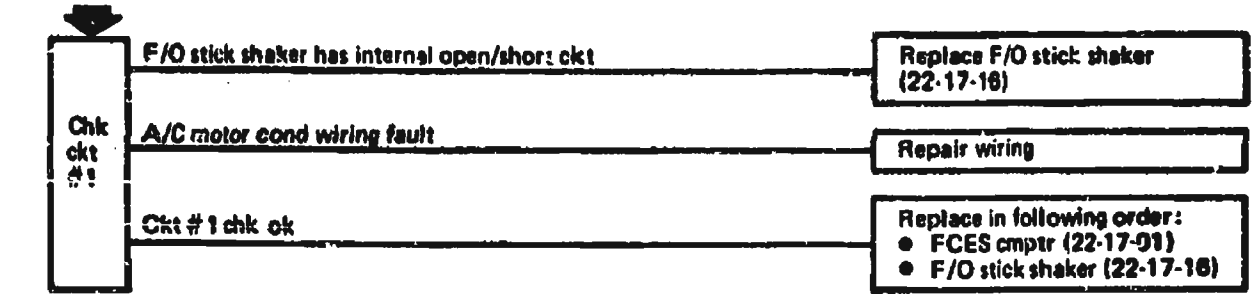
M1-0001-22-674

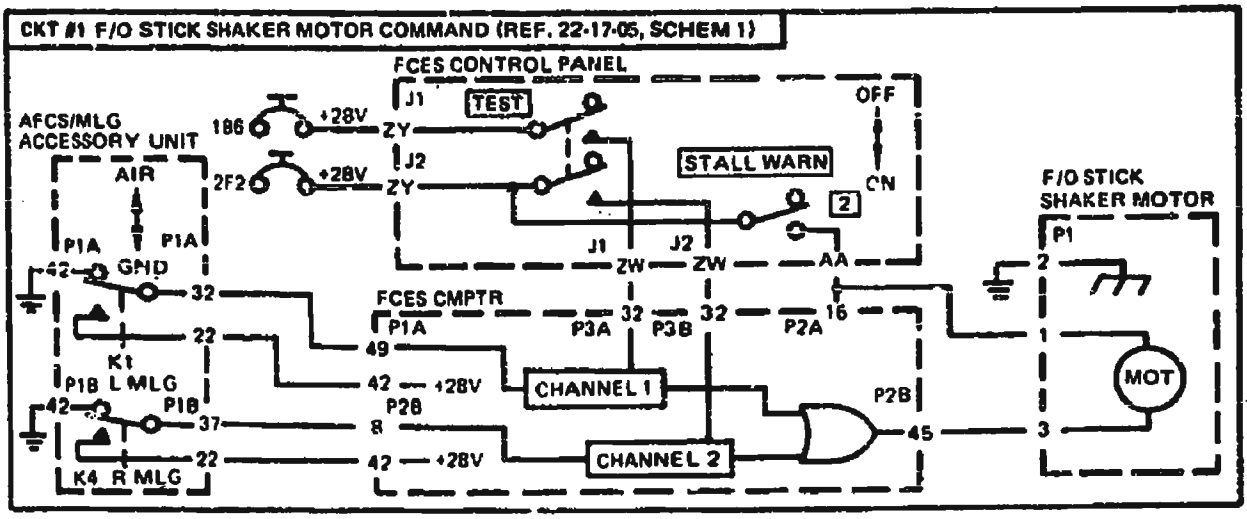
R Stall Warn System Fault Matrix
R Figure 103 (Sheet 2)

EFFECTIVITY: ALL

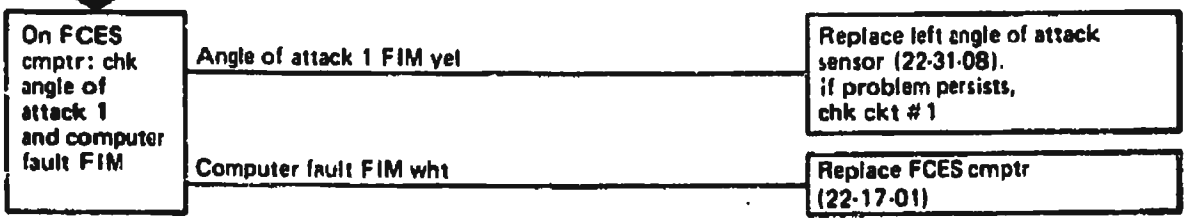
001B

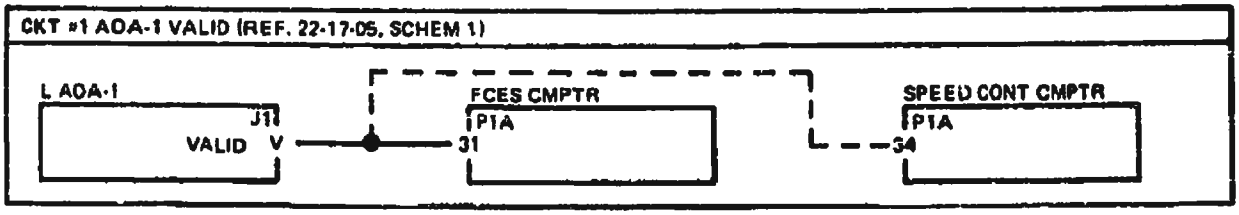
1 STICK SHAKER DID NOT OPERATE DURING DUAL CHANNEL TEST.


Chk ckt #1
F/O stick shaker has internal open/short ckt
Replace F/O stick shaker (22-17-16)
A/C motor cond wiring fault
Repair wiring
Ckt # 1 chk ok
Replace in following order:
• FCES cmptr (22-17-01)
• F/O stick shaker (22-17-16)



2 SYSTEM 1 STALL WARN FAIL LIGHT ON DURING TEST, STICK SHAKER OK. SYSTEM 2 TURNED OFF.


On FCES cmptr: chk angle of attack 1 and computer fault FIM
Angle of attack 1 FIM yel
Replace left angle of attack sensor (22-31-08). if problem persists, chk ckt # 1
Computer fault FIM wht
Replace FCES cmptr (22-17-01)



M1-0005-22-675

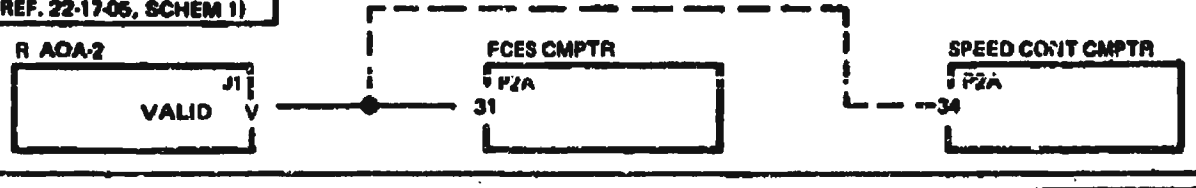
Stall Warn Test Faults
Figure 104 (Sheet 1)

3 SYSTEM 2 STALL WARN FAIL LIGHT ON DURING TEST, STICK SHAKER OK. SYSTEM 1 TURNED OFF.

On FCES cmptr: chk angle of attack 2 and computer fault FIM

- Angle of attack 2 FIM yel → Replace right angle of attack sensor (22-31-06). If problem persists, chk ckt # 1.
- Computer fault FIM wht → Replace FCES cmptr (22-17-01)

CKT #1 AOA-2 VALID (REF. 22-17-05, SCHEM 1)

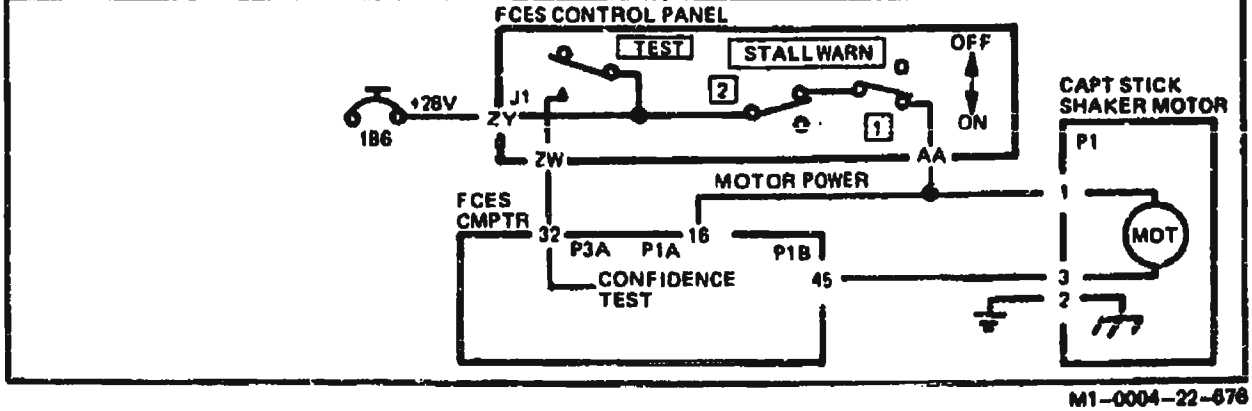


4 STICK SHAKER DID NOT OPERATE DURING CHANNEL 1 STALL WARN TEST, FAIL LIGHT OFF. SYS 2 TURNED OFF.

Does FAIL light come on when TEST sw was pressed for over 2 seconds?

- Yes → GO TO FAULT 6
- No → Chk ckt #1
  - Capt stick shaker motor has internal open/short ckt → Replace Capt stick shaker (22-17-16).
  - FCES control panel has internal open → Replace FCES control panel (22-10-07).
  - Ckt #1 chk ok → Replace FCES computer (22-17-01).
  - A/C wiring fault → Repair wiring.

CKT #1 CAPT STICK SHAKER MOTOR POWER, MOTOR COMMAND (REF. 22-17-05, SCHEM 1)



M1-0004-22-676

Stall Warn Test Faults
Figure 104 (Sheet 2)

5 STICK SHAKER DID NOT OPERATE DURING CHANNEL 2 STALL WARN TEST, FAIL LIGHT OFF. SYSTEM 1 TURNED OFF.

Does FAIL light come on when TEST sw was pressed for over 2 seconds?

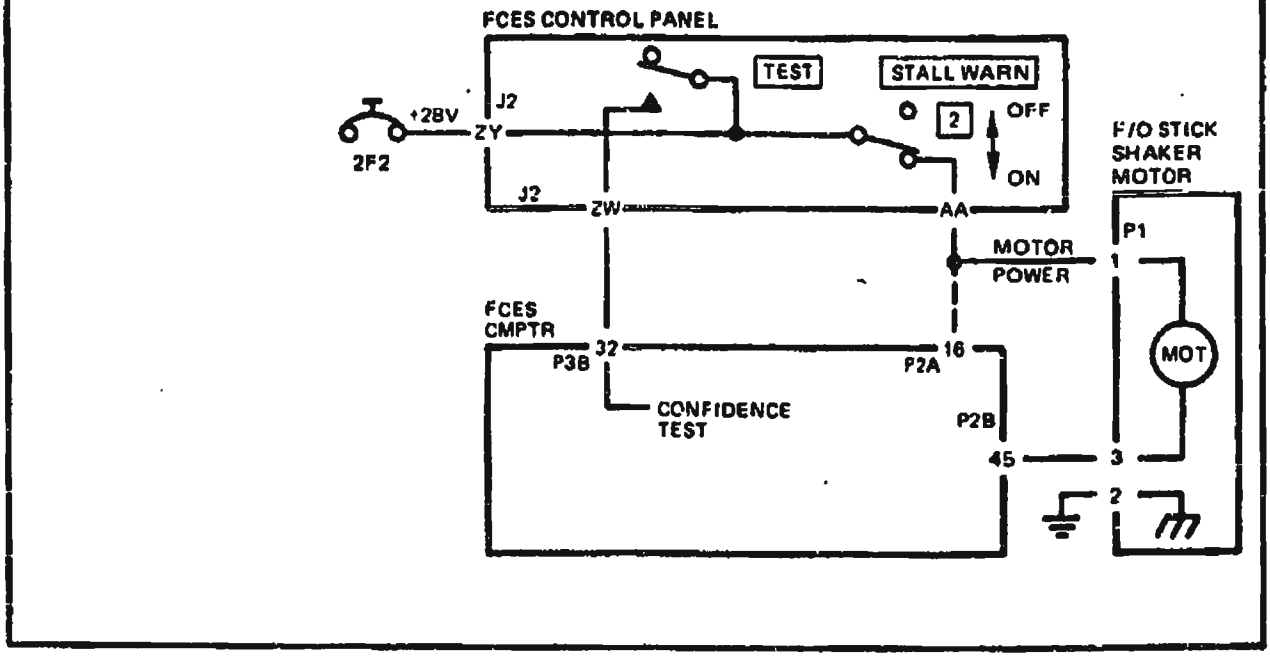
Yes → GO TO FAULT 7

No

Chk Ckt #1

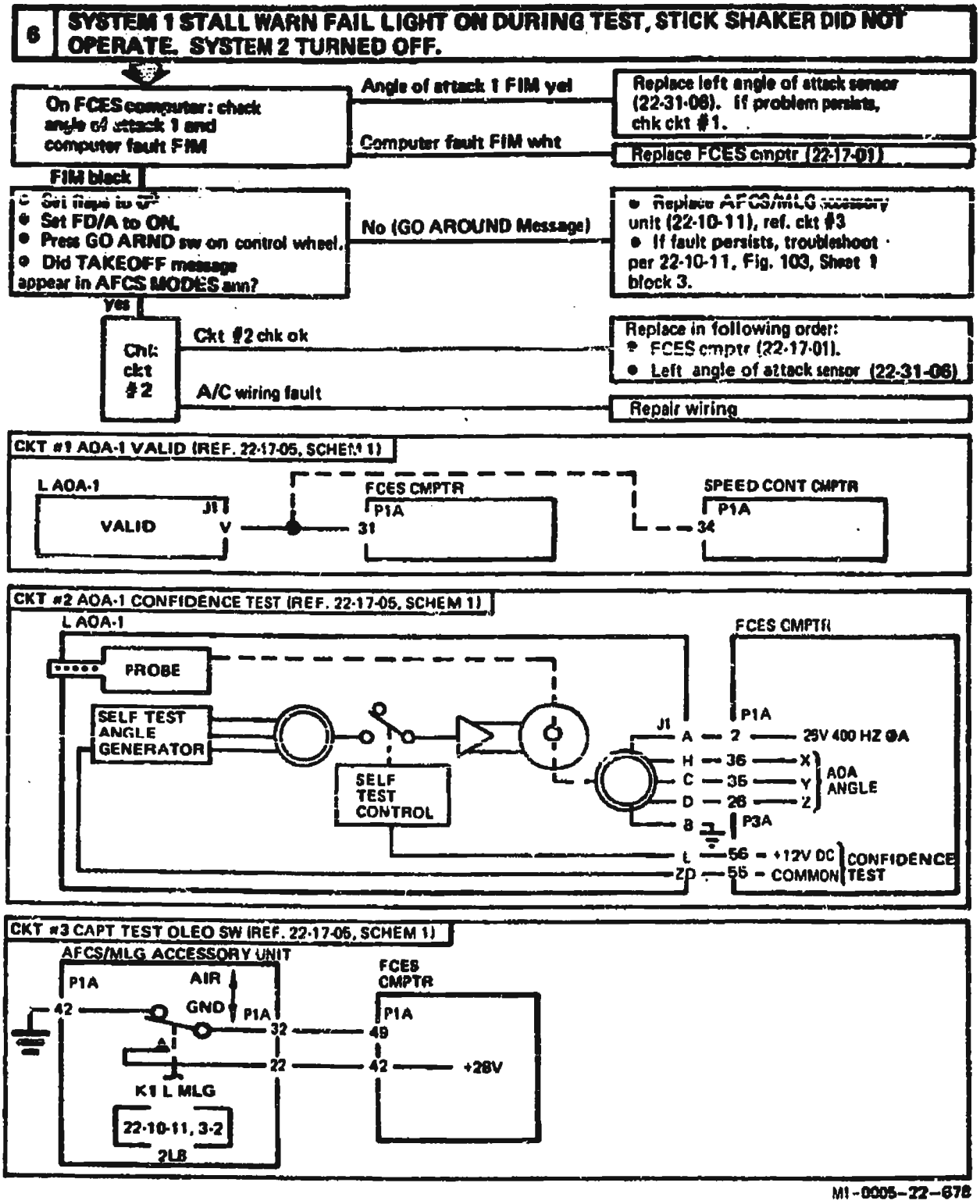
- F/O stick shaker motor has internal open/shut ckt → Replace F/O stick shaker (22-17-16).
- FCES control panel has internal open → Replace FCES control panel (22-10-07)
- Ckt #1 chk ok → Replace FCES computer (22-17-01)
- A/C wiring fault → Repair wiring

CKT #1 F/O STICK SHAKER MOTOR POWER, MOTOR COMMAND (REF. 22-17-05, SCHEM 1)



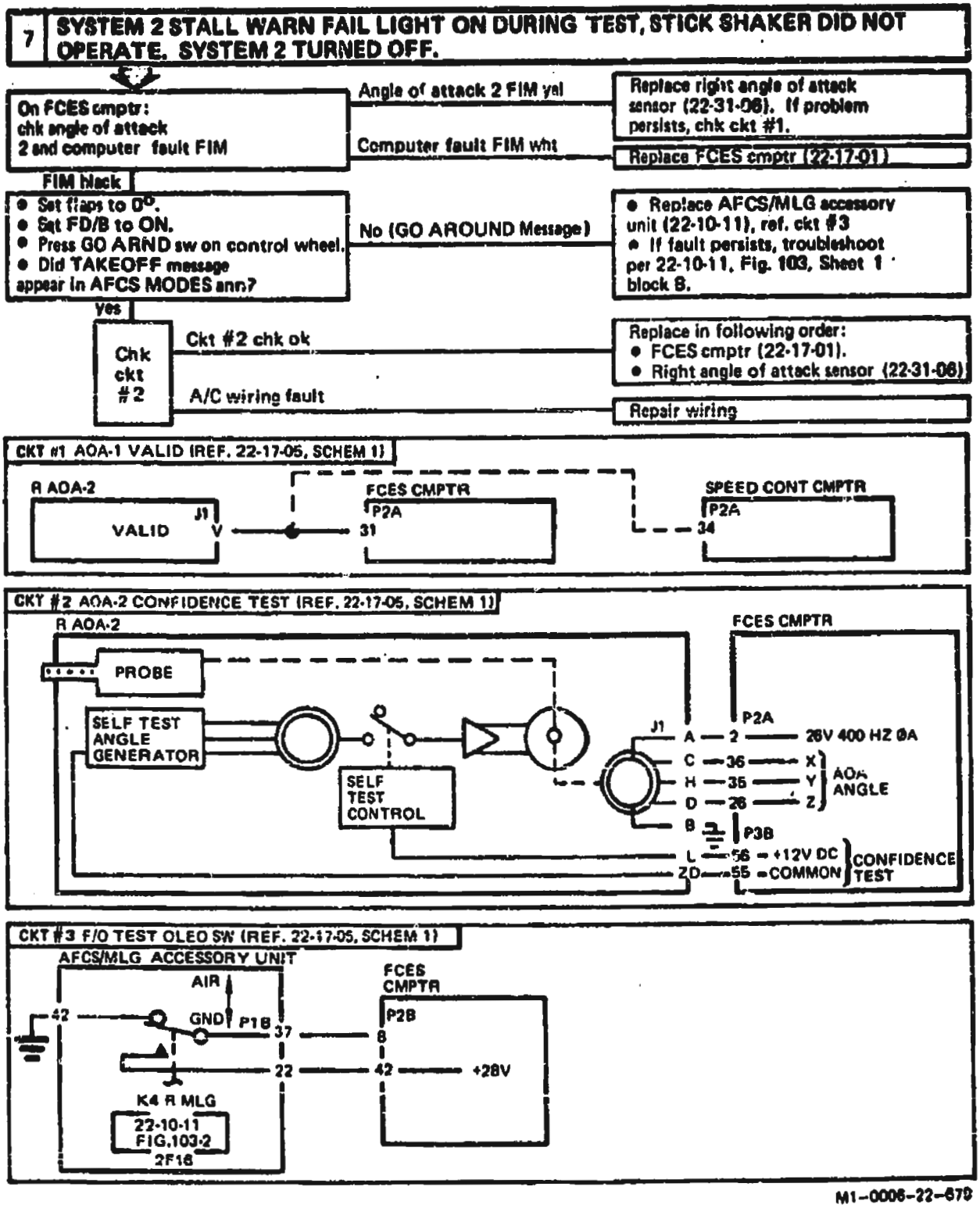
M1-0005-22-877

Stall Warn Test Faults
Figure 104 (Sheet 3)



M1-0005-22-678

Stall Warn Test Faults
Figure 104 (Sheet 4)



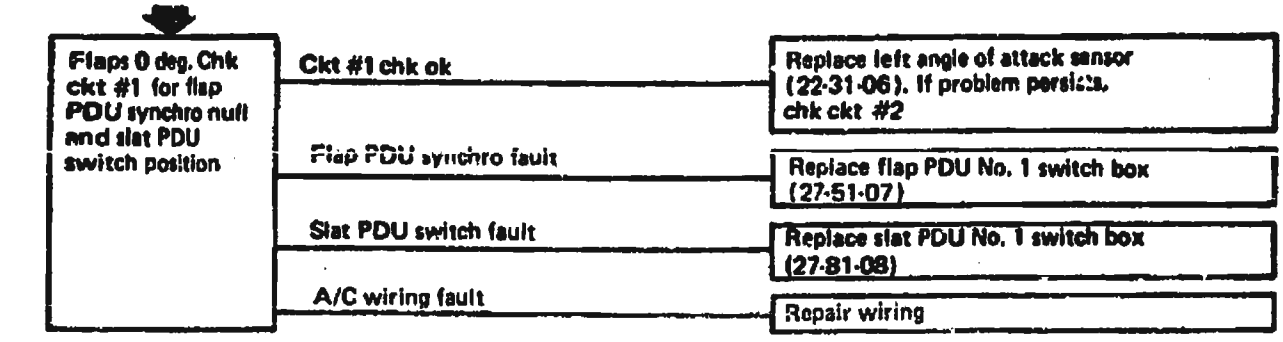
M1-0006-22-670

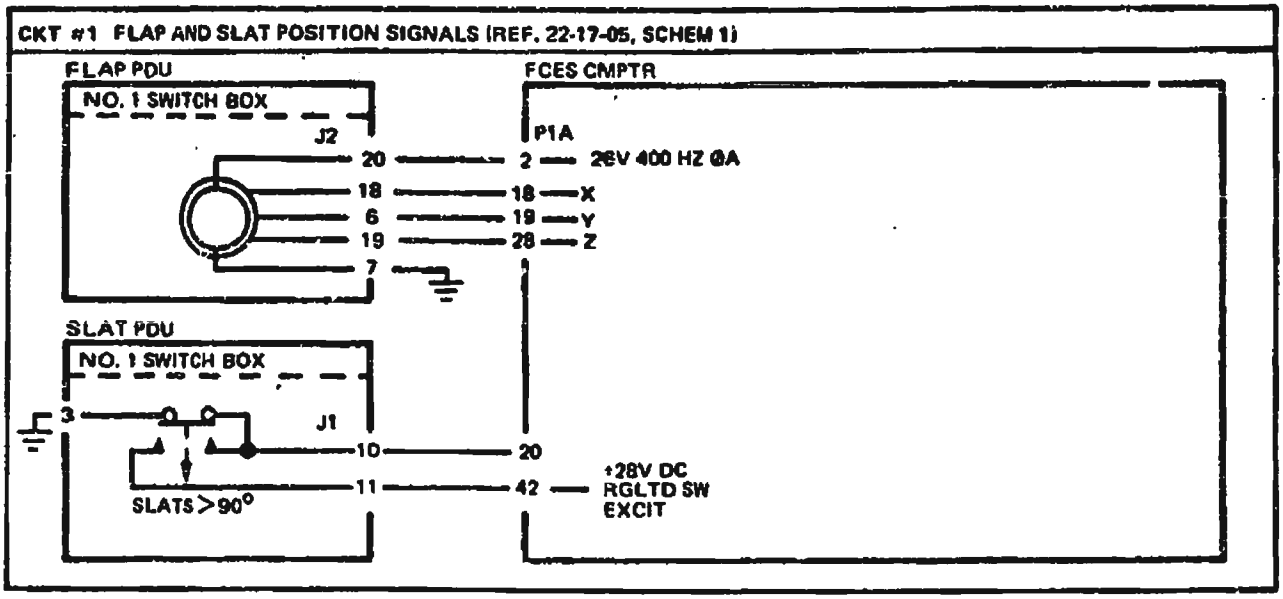
R Stall Warn Test Faults
R Figure 104 (Sheet 5)

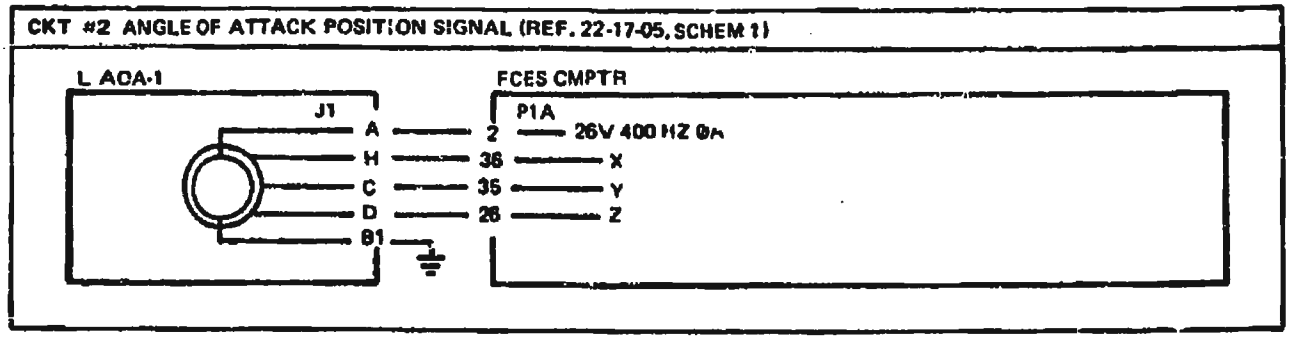
EFFECTIVITY: ALL

001B

10 STICK SHAKER OPERATES DURING ROTATION, STALL WARN FAIL LIGHT OUT. FAULT ISOLATED TO STALL WARN SYSTEM 1 BY SWITCHING ONE SYSTEM OFF AT A TIME.


Flaps 0 deg. Chk ckt #1 for flap PDU synchro null and slat PDU switch position
Ckt #1 chk ok
Replace left angle of attack sensor (22-31-06). If problem persists, chk ckt #2
Flap PDU synchro fault
Replace flap PDU No. 1 switch box (27-51-07)
Slat PDU switch fault
Replace slat PDU No. 1 switch box (27-81-08)
A/C wiring fault
Repair wiring





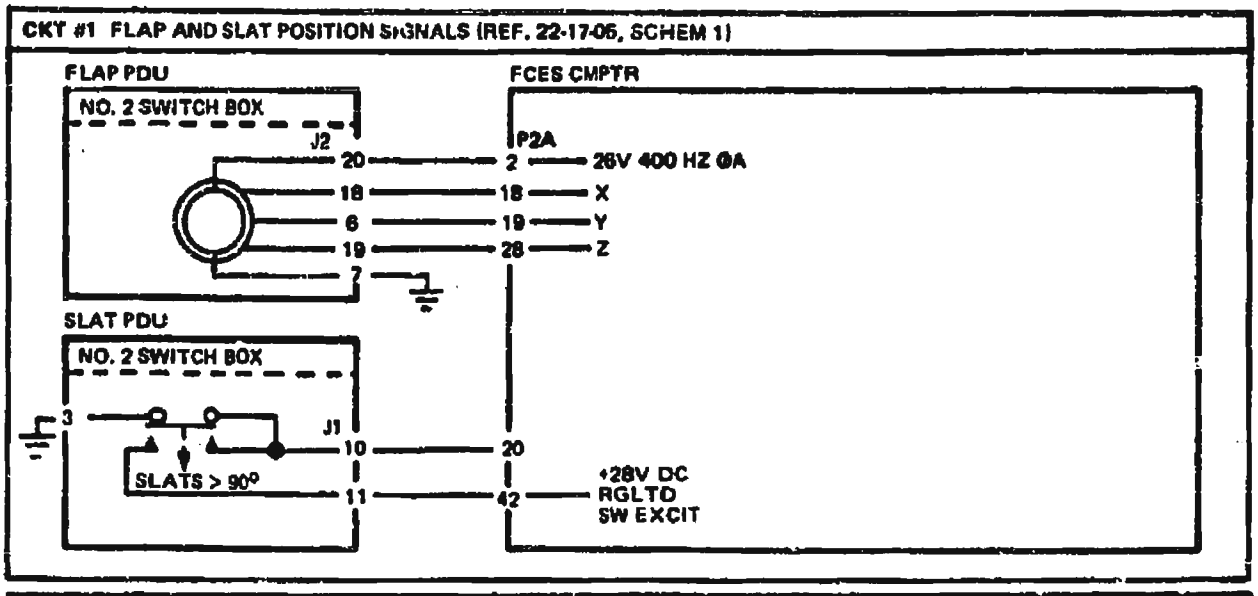
M1-0003-22-681

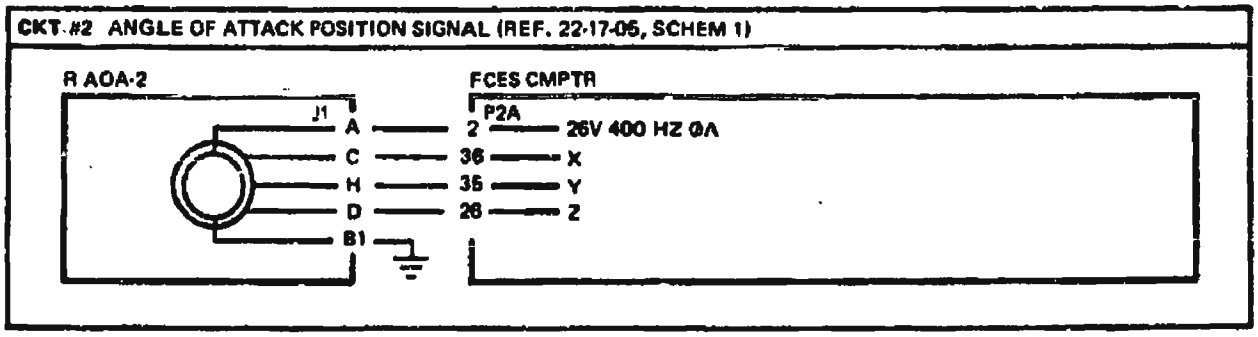
Stall Warn Faults
Figure 105 (Sheet 1)

11 STICK SHAKER OPERATES DURING ROTATION, STALL WARN FAIL LIGHT OUT. FAULT ISOLATED TO STALL WARN SYSTEM 2 BY SWITCHING ONE SYSTEM OFF AT A TIME.

Flap 0 deg. Chk ckt #1 for flap PDU synchro null and slat PDU switch position

- Ckt #1 chk ok: → Replace right angle of attack sensor (22-31-06). If problem persists, chk ckt #2.
- Flap PDU synchro fault → Replace flap PDU No. 2 switch box (27-51-07)
- Slat PDU switch fault → Replace slat PDU No. 2 switch box (27-81-08)
- A/C wiring fault → Repair wiring

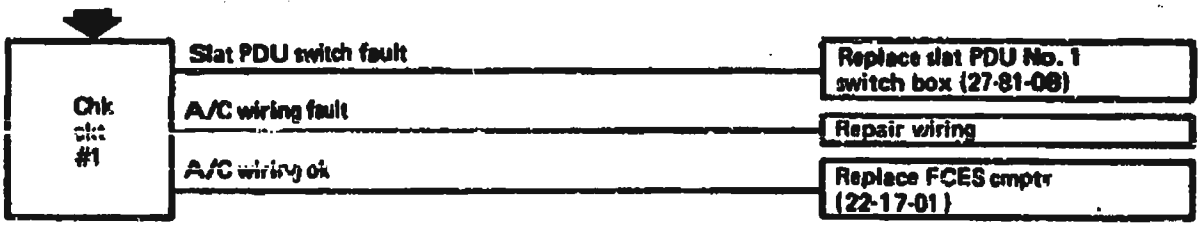


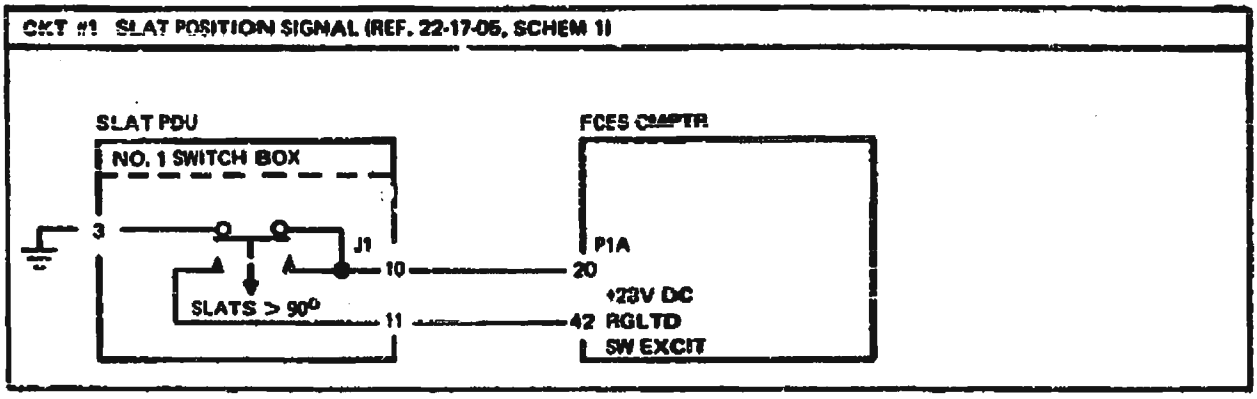


M1-0004-22-682

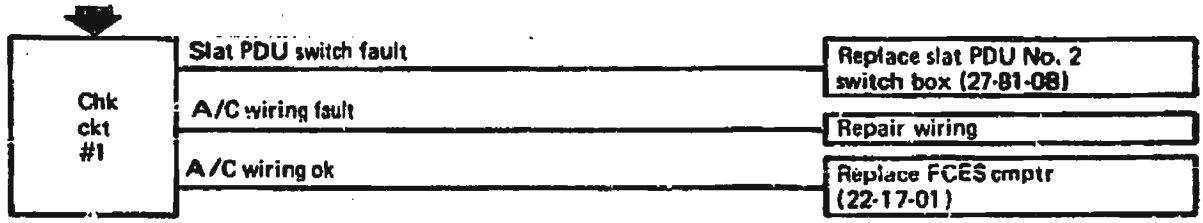
R Stall Warn Faults
R Figure 105 (Sheet 2)

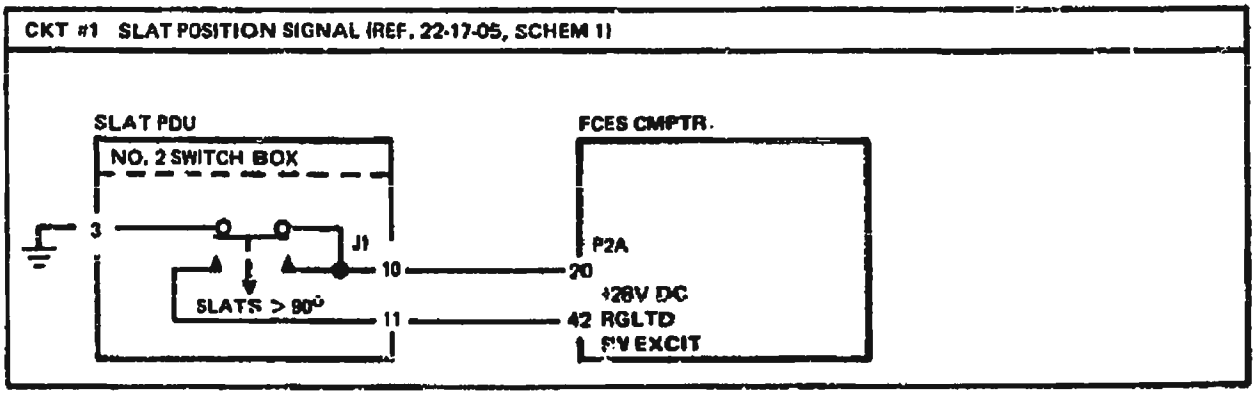
12 STICK SHAKER OPERATES WITH FLAPS EXTENDED, STILL WARN LIGHT OUT. FAULT ISOLATED TO STALL WARN SYSTEM 1 BY SWITCHING ONE SYSTEM OFF AT A TIME.





13 STICK SHAKER OPERATES WITH FLAPS EXTENDED, STALL WARN LIGHT OUT. FAULT ISOLATED TO STALL WARN SYSTEM 2 BY SWITCHCHING ONE SYSTEM OFF AT A TIME.





M1-000J-22-883

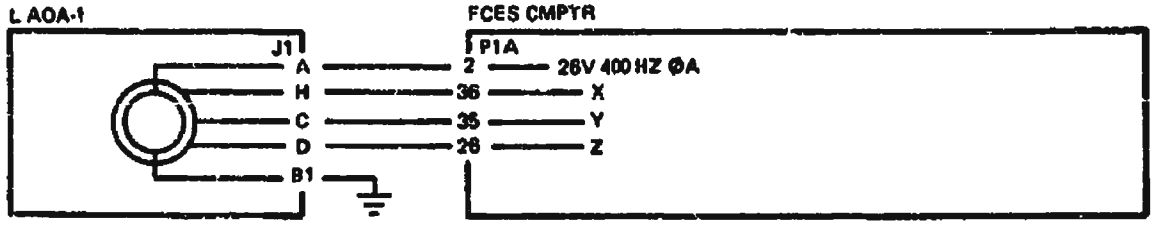
Stall Warn Faults
Figure 105 (Sheet 3)

14 STALL WARN 1 FAIL LIGHT ON, ALL OTHER INDICATIONS NORMAL

On FCES cmptr: chk computer fault FIM and Angle of Attack 1 FIM

- Computer fault FIM wht → Replace FCES cmptr (22-17-01)
- Angle of attack 1 FIM yellow → Replace left angle of attack sensor (22-31-06). If problem persists, chk ckt # 1

CKT # 1 ANGLE OF ATTACK POSITION SIGNAL (REF. 22-17-05, SCHEM 1)



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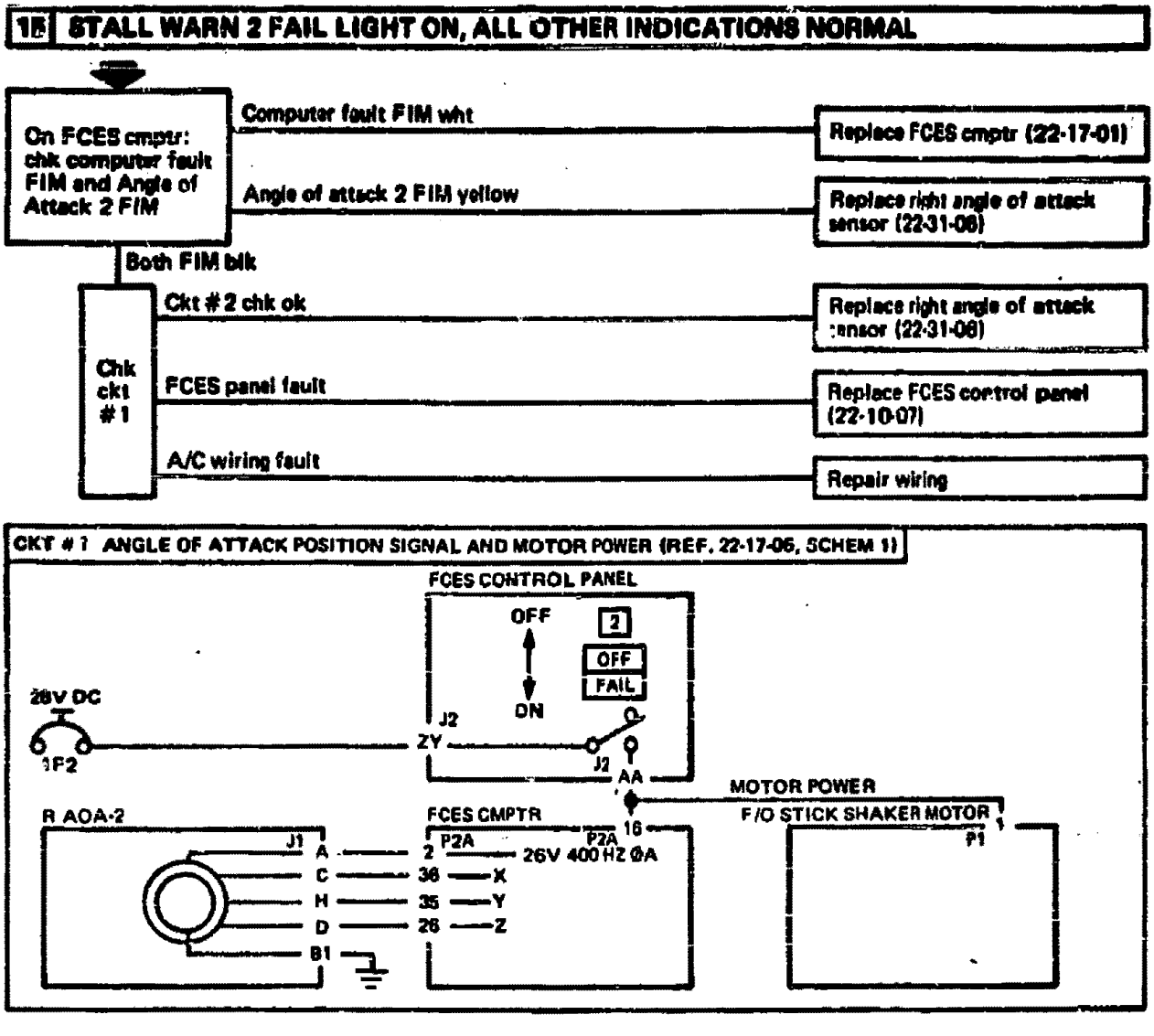
R Stall Warn Faults
R Figure 105 (Sheet 4)



M1-0004-22-005

R Stall Warn Faults
R Figure 105 (Sheet 5)

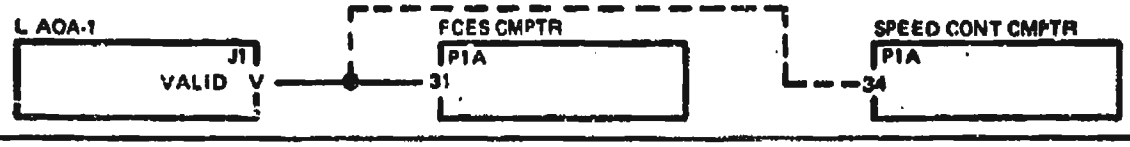
EFFECTIVITY: ALL

001B

16 NO. 1 STALL WARN AND NO. 1 ATS FAIL LIGHTS ON

Angle of attack 1 FIM on FCES cmptr → Replace left angle of attack sensor (22-31-06). If problem persists, chk ckt #1.

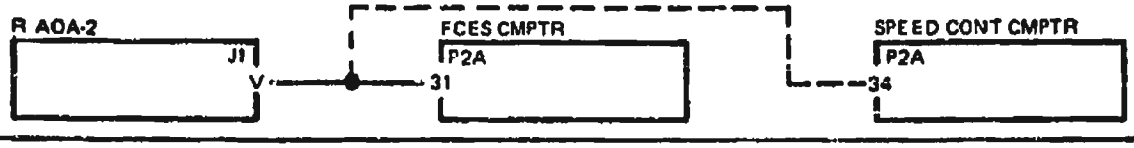
CKT #1 AOA-1 VALID (REF. 22-17-05, SCHEM 1)



17 NO. 2 STALL WARN AND NO. 2 ATS FAIL LIGHTS ON

Angle of attack 2 FIM on FCES cmptr → Replace right angle of attack sensor (22-31-06). If problem persists, chk ckt #1

CKT #1 AOA-2 VALID (REF. 22-17-05, SCHEM 1)



18 BOTH STALL WARN FAIL LIGHTS ON, ALL OTHER INDICATIONS NORMAL

Computer fault FIM on FCES cmptr → Replace FCES cmptr (22-17-01)

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Stall Warn Faults
Figure 105 (Sheet 6)

EFFECTIVITY: ALL

001B

19	STICK SHAKER ON FOR NO APPARANT REASON, AND ATS FAIL LIGHTS ON. FAULT WAS ISOLATED TO STALL WARNING SYSTEM 1 (2), BY SWITCHING ONE SYSTEM OFF AT A TIME.

Was System 1 or 2 FAULT?

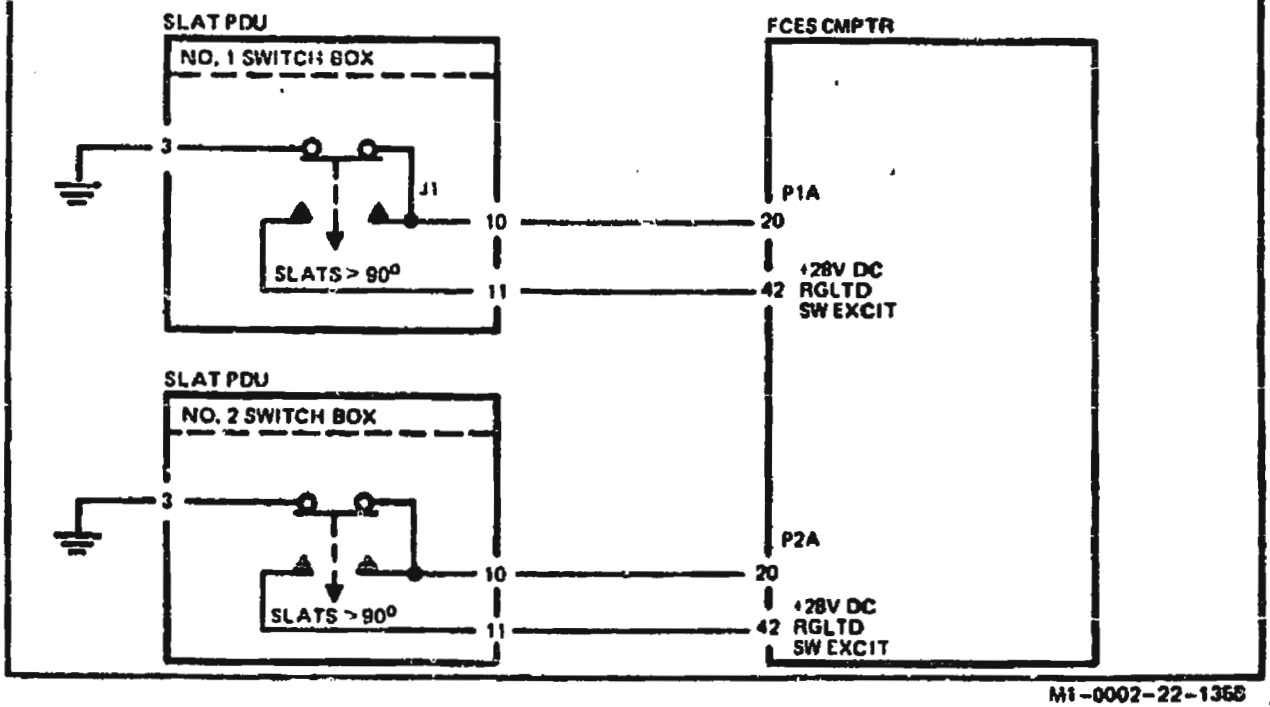
- System 1 → Replace left angle of attack sensor (22-31-08)
- System 2 → Replace right angle of attack sensor (22-31-08)

20	WHEN FLAPS SELECTED TO 4 DEGREES ON GROUND, STALL WARN 1 (2) FAIL LIGHT CAME ON. SYSTEM RESET. OK ON OTHER FLAP SELECTIONS.

Check slat PDU switch box for short when 4 degrees flap are selected per ckt # 1. No. 1 switch box for system 1 and No. 2 switch box for system 2.

- Short in system 1 → Replace slat PDU No. 1 switchbox (27-81-08)
- Short in system 2 → Replace slat PDU No. 2 switchbox (27-81-08)

CKT # 1 SLAT POSITION SIGNAL (REF. 22-17-05, SCHEM 1)



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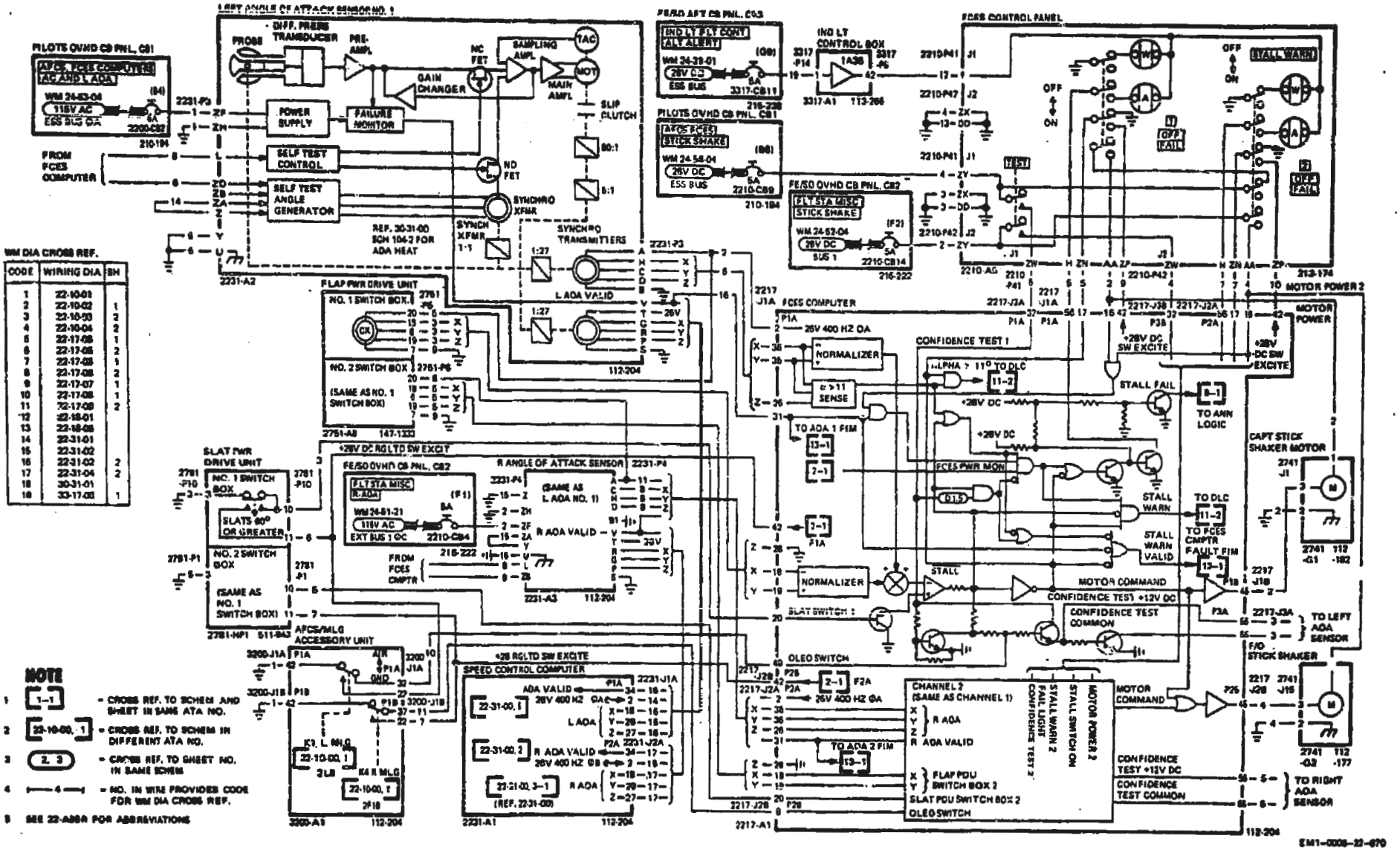
Stall Warn Faults
Figure 105 (Sheet 7)

EFFECTIVITY: ALL

001B



R Stall Warn Schematic
R SCHEM 1

EFFECTIVITY: ALL

001B

STALL WARN SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedures

R 21-00-00 Air Conditioning System - Maintenance Practices

24-00-00 Electrical Power - Maintenance Practices

2. Stall Warn Test

The stall warning test procedure (Ref. Table 501) consists of a test procedure, normal observations, and corrective actions. The test procedure and normal observations are used to verify the operational status of the system. When a fault occurs during the test, perform corrective actions adjacent to fault indications.

A. Preliminary Procedure

(1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that avionics cooling is on (Ref. 21-00-00).

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

All circuit breakers on AVIONICS FLIGHT CONTROL SYSTEM strips

26 VAC NAV EXCITATION

ALT ALERT-1 (K27)

ALT ALERT-2 (J21)

(4) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

FLIGHT STATION MISC

R AOA (F1)

STICK SHAKE (F2)

(5) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

Stall Warning Fault Isolation
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		PERFORM PRELIMINARY PROCEDURE	
R	A. FCES panel • Latch STALL WARN 1 and 2 to on.	STALL WARN 1 and 2 OFF legend off.	Test OK.
R		STALL WARN 1 and 2 FAIL legends plus FLT CONT PANELS legend come on.	1. Check FCES computer FIM ball. • If white, reset. If still white replace FCES computer. • If black, go to Step 2. 2. Depress and hold STALL WARN TEST switch for approx. 5 sec. • If control column shakes, replace FCES computer. • If control column does not shake (loss of channel 2 motor power), go to step 3. 3. To confirm loss of channel 2 motor power, depress STALL WARN 2 to OFF. STALL WARN FAIL 1 legend goes out. • On CB2, verify that FLT STA MISC STICK SHAKE (F2) circuit breaker is closed. • Replace FCES control panel. • Replace stick shaker motor No. 2. • Check channel 2 motor power wiring (Ref. 22-17-00, SCHEM 3).
R R		STALL WARN 1 or 2 FAIL legend plus FLT CONT PANELS legend come on.	1. Check FCES computer FIM. • If white, replace FCES computer. • If black, go to Step 2.

Stall Warning Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
			2. Check corresponding ANGLE OF ATTACK FIM on FCES computer: • If yellow, reset.
			• If still yellow, replace corresponding angle of attack sensor. • Check angle of attack valid wiring (Ref. 22-17-00, SCHEM 3).
		Control column shakes.	1. Replace AFCS/MLG accessory unit. 2. Replace FCES computer. 3. Check air/ground wiring between AFCS/MLG accessory unit and FCES Computer (Ref. 22-17-00, SCHEM 3).
R R	B. Unlatch STALL WARN 2 to OFF.	STALL WARN 2 OFF legend on.	Test OK.
R R		STALL WARN 1 FAIL legend plus FLT CONT PANELS legend come on.	1. Depress and hold STALL WARN TEST switch for approx. 5 sec. • If control column shakes, replace FCES computer. • If control column does not shake (loss of channel 1 motor power), go to Step 2.

Stall Warning Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
			2. Check for loss of channel 1 motor power as follows: • On CB1, verify that FCES STICK SHAKE (B6) circuit breaker is closed. • Replace FCES control panel. •Replace stick shaker motor No. 1. • Check channel 1 motor power wiring (Ref. 22-17-00, SCHEM 3).
R	C. Depress and hold STALL WARN TEST for approx. 5 sec.	Control columns shake, and STALL WARN 1 FAIL legend remains off.	Test OK.
R R R R		No shake, and STALL WARN 1 FAIL legend comes on only when TEST switch depressed. Also FLT CONT PANELS legend comes on.	1. Replace AFCS/MLG accessory unit. 2. Replace FCES computer. 3. Check AFCS/MLG accessory unit air/ground wiring and left angle of attack unit wiring (Ref. 22-17-00, SCHEM 3). 4. Replace left angle of attack sensor.
R		No shake, and STALL WARN 1 FAIL legend plus FLT CONT PANELS legend comes on.	1. Check FCES computer FIM. • If white, replace FCES computer. • If black, go to Step 2.

Stall Warning Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		2. Check ANGLE OF ATTACK 1 FIM on FCES computer. • If yellow, reset. • If still yellow, check left angle of attack valid wiring (Ref. 22-17-00, SCHEM 3). • If black, go to Step 3.

WARNING: DO NOT ROTATE ANGLE OF ATTACK PROBE UNLESS THE FOLLOWING WARNINGS ARE OBSERVED:

1. PROBE HEATERS SHALL BE OFF.

2. APPLICABLE ANGLE OF ATTACK CIRCUIT BREAKER SHALL BE OPEN.

   CB1 panel, L AOA (B5)

   CB2 panel, R AOA (F1)

3. DO NOT USE GLOVES OR TOOLS.

4. USE BARE HANDS.

5. DO NOT COVER HOLES IN PROBE.

6. HOLD SHAFT CLOSE TO FUSELAGE AS POSSIBLE AND DO NOT TOUCH HOLES.

7. TURN PROBE SLOWLY.

8. DO NOT ATTEMPT TO TURN PROBES BEYOND STOPS.

Stall Warning Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R R R R R			3. Alternate check: (a) On CB1, open FCES COMPUTERS AC & L AOA (B5) circuit breaker. (b) Observing WARNING, position left probe until forward edge of probe is full up (no stall). (c) On CB1, close B5. (d) While observing left probe, depress and hold STALL WARN TEST approx. 5 sec. • If left probe moved to end of down travel (stall), replace FCES computer. • If no movement, go to Step (e). (e) On CB1, open B5. (f) Observing WARNING, position left probe until forward edge of probe is full down (stall). (g) On CB1, close B5. (h) Depress and hold STALL WARN TEST for approx. 5 sec. • If shake occurs and FAIL legend comes on, replace FCES computer. • If no shake occurs and FAIL legend remains off, replace left angle of attack sensor.
R		No shake (No. 1 shaker) and STALL WARN 1 FAIL legend remains off.	1. Depress STALL WARN 2 to on. 2. On CB2, open FLT STA MISC R AOA (F1) circuit breaker.

Stall Warning Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
			3. Depress and hold STALL WARN TEST for approx. 5 sec. • If shake occurs, replace Captains stick shaker. Check wiring to Capt stick shaker motor (Ref. 22-17-00, SCHEM 3). • If no shake occurs , go to Step 4.
R			4. Unlatch STALL WARN 2 to off.
R			5. On CB2, close F1.
			6. Replace FCES computer.
			7. Replace FCES control panel.
			8. Check channel 1 confidence test and No. 1 shaker wiring (Ref. 22-17-00, SCHEM 3).
R	D. Unlatch STALL WARN 1 to off.	STALL WARN 1 OFF legend on.	No test.
R	E. Latch STALL WARN 2 to on.	STALL WARN 2 OFF legend off.	No test.
R	F. Depress and hold STALL WARN TEST for approx. 5 sec.	Control columns shake, and STALL WARN 2 FAIL legend remains off.	Test OK.
R		No shake, and STALL WARN 2 FAIL legend on only when TEST switch depressed. Also FLT CONT PANELS legend comes on.	1. Replace AFCS/MLG accessory unit.
R			2. Replace FCES computer.

Stall Warning Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
			3. Check AFCS/MLG accessory unit air ground wiring and right angle of attack unit wiring (Ref. 22-17-00, SCHEM 3).
R R R R		No shake (No. 2 shaker) and STALL WARN 2 FAIL legend on plus FLT CONT PANELS legend comes on.	1. Check FCES computer FIM. • If white, replace FCES computer. • If black, go to Step 2. 2. Check ANGLE OF ATTACK 2 FIM on FCES computer. • If yellow, reset. • If still yellow, check right angle of attack valid wiring (Ref. 22-17-00, SCHEM 3). • If black, go to Step 3.

R Stall Warning Fault Isolation (Cont)
R Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
WARNING: DO NOT ROTATE ANGLE OF ATTACK PROBE UNLESS THE FOLLOWING WARNINGS ARE OBSERVED: 1. PROBE HEATERS SHALL BE OFF. 2. APPLICABLE ANGLE OF ATTACK CIRCUIT BREAKER SHALL BE OPEN. CB1 panel, L AOA (B5) CB2 panel, R AOA (F1) 3. DO NOT USE GLOVES OR TOOLS 4. USE BARE HANDS 5. DO NOT COVER HOLES IN PROBE. 6. HOLD SHAFT CLOSE TO FUSELAGE AS POSSIBLE AND DO NOT TOUCH HOLES. 7. TURN PROBE SLOWLY. 8. DO NOT ATTEMPT TO TURN PROBES BEYOND STOPS.		3. Alternate check: (a) On CB2, open FLT STA MISC R AOA (F1) circuit breaker. (b) Observing WARNING, position right probe until forward edge is full up (no stall). (c) On CB2, close F1.

Stall Warning Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
			3. (d) While observing right probe, depress and hold STALL WARN TEST for approx. 5 sec. • If right probe moved to end of down travel (stall), replace FCES computer. • If no movement, go to Step (e). (e) On CB2, open F1. (f) Observing WARNING, position right probe until forward edge of probe is full down (stall). (g) On CB2, close F1. (h) Depress and hold STALL WARN TEST for approx. 5 sec. • If shake occurs and
R R R R			FAIL legend comes on, replace FCES computer. • If no shake occurs and FAIL legend remains off, replace right angle of attack probe.
R		No shake (No. 2 shaker), and STALL WARN 2 FAIL legend remains off.	1. Depress STALL WARN 1 to on. 2. On CB2, open FLT STA MISC R AOA (F1) circuit breaker. 3. Depress and hold STALL WARN TEST for approx. 5 sec.
R			• If no shake occurs, replace First Officer stick shaker. Check wiring to First Officers stick shaker motor (Ref. 22-17-00, SCHEM 3). • If shake occurs, go to Step 4.

Stall Warning Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R			4. Unlatch STALL 1 to off. 5. On CB2, close F1. 6. Replace FCES computer. 7. Replace FCES control panel. 8. Check channel 2 confidence test and No. 2 shaker wiring (Ref. 22-17-00, SCHEM 3).
R R R	G. Latch STALL WARN 1 to on.	STALL WARN 1 OFF legend off.	No test.
R R R	H. Depress and hold STALL WARN TEST for approx. 5 sec.	Control columns shake and STALL WARN FAIL legends remain off.	Test OK.
	I. Turn off electrical power.	No test.	No test.

R ALTITUDE ALERT SYSTEM - FAULT ISOLATION

R General

R Reference data and fault isolation procedures for troubleshooting altitude alert faults are included in this section of the manual. An altitude alert malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use altitude alert fault matrix.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Identification

R Table 101 is a list of the altitude alert fault isolation diagrams and schematics. Figure 101 and 102 provide component location for altitude alert troubleshooting.

R A. General

R Altitude alert fault isolation contains one level of troubleshooting: fault oriented. Fault oriented fault isolation trouble shoots a specific altitude alert problem.

R B. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the altitude alert system by a specific fault number. It also identifies and locates the LRUs which can cause the problem.

R Figures 104 thru 106 provide diagnostic steps to further isolate the fault. The diagnostic steps are in a flow chart form which contains complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the actions are outside the blocks. When using the flow charts,

R it is assumed that systems are in the normal operational
R mode, all relevant circuit breakers have been checked, and
R all applicable aircraft operational procedures have been
R accomplished.

R Autopilot fault isolation procedures do not contain
R PREREQUISITES. Instead, when uncertainty exists regarding
R setup and circuit breaker information, reference should be
R made to the sub-system Adjustment and Test procedure
R (22-17-00, page 501).

R Fault Isolation Diagram and Schematic List
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Altitude Alert Fault Matrix
104	Altitude Alert Approach Faults
105	Altitude Alert Deviation Faults
106	Altitude Alert Test Faults
MM 22-17-00 SCHEM 4	Altitude Alert Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
BOX – INDICATOR LIGHTS CONTROL (CARD 1A35)	1	FESC, AFT OF ELEK RACK/112AB	33-17-04
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – FLIGHT CONTROL ELECTRONICS SYSTEM	1	FESC, CTR RACK/112AB	22-17-01
INDICATOR – ALTITUDE ALERT (INDICATOR LIGHT, RECTANGULAR)	2	FLT STA, CAPT & F/O INSTR PNL	20-33-04
INDICATOR – BAROMETRIC ALTITUDE	2	FLT STA, CAPT & F/O INSTR PNL	34-14-03
PANEL – ALTITUDE SELECT	1	FLT STA, GLRSHLD PNL	22-11-03
UNIT – AURAL WARNING	1	FLT STA, UNDER FE/SO CSL	31-22-03

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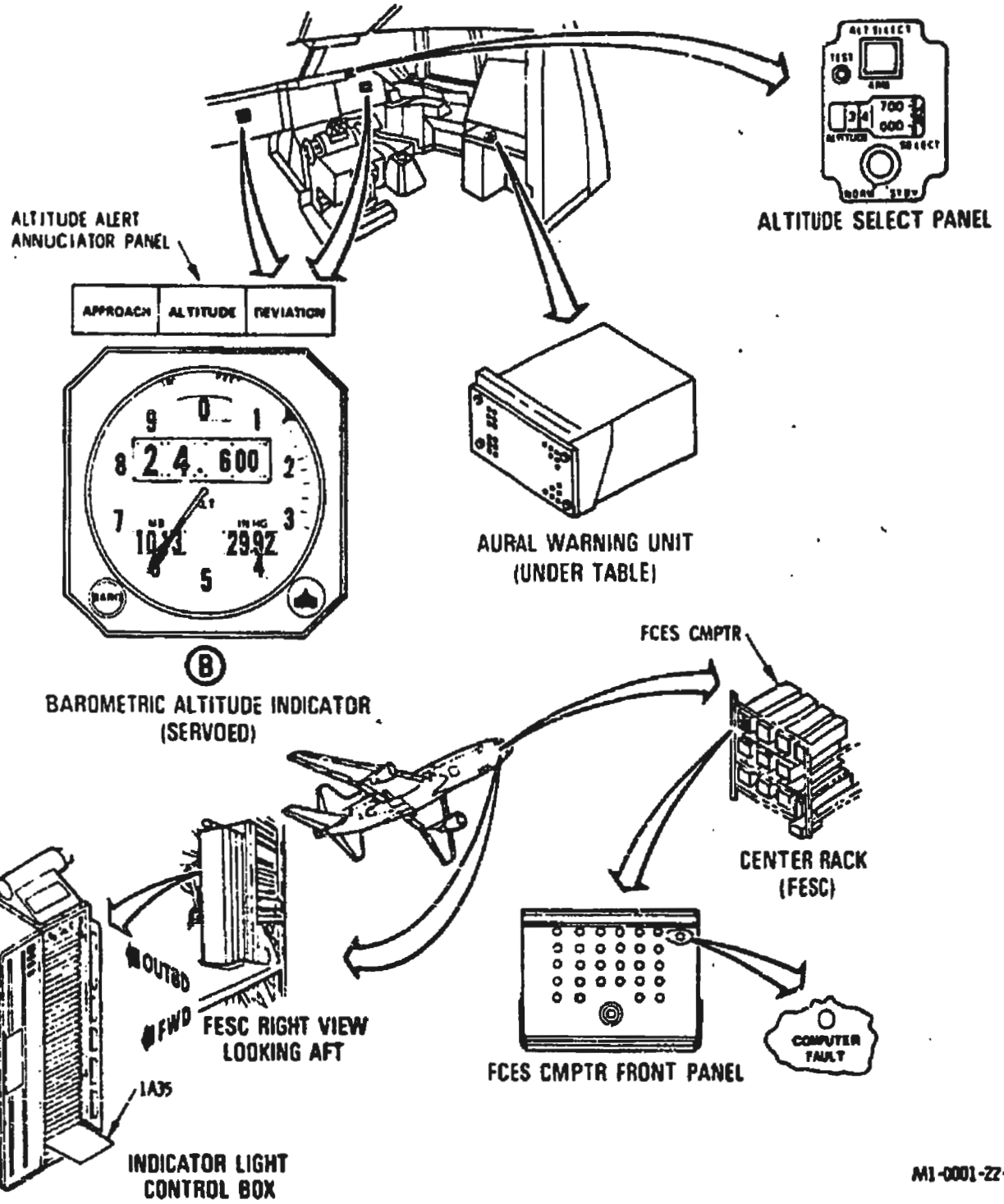
Component Location Index
Figure 101

EFFECTIVITY: ALL

001B



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Component Locator Diagram
Figure 102

FAULTS		FIM		NO FIM				
No.	Problem (Capt or F/O) Capt FIRM Codes With -1 / F/O FIRM Codes With -2 X — Use With Both FIRM Codes	Troubleshooting Faulty LRU						
		Check FIM		Continuity Check or Replace				
		ADC	FC	ASP	AWU	BARO	ILCB	FC
"ALTITUDE ALERT APPROACH" FAULTS (REF. FIG. 104)								
1	APPROACH annunciators remained on and ALTITUDE annunciators failed to light when aircraft reached selected alt. System operation normal in (NORM, STBY) position		X	X		1/2		
2	ALTITUDE annunciator out at selected altitude. System operation normal in (NORM, STBY) position		X	X		1/2		
3	Altitude alert aural warning failed to sound during approach to selected altitude		X		X			
4	Altitude alert aural warning failed to sound during approach to selected altitude. ALTITUDE annunciator out		X					
5	APPROACH annunciator failed to operate when aircraft approached selected altitude		X					
6	Flag in view on alt sel panel, no flags on baro altimeters		X					
7	Flag in view on alt sel panel and Capt or F/O baro altimeters	Note No. 1				Note No. 1		
8	Altitude select knob jammed or loose			X				
9	APPROACH and ALTITUDE annunciators flash continuously at selected altitude. System operation normal in (NORM, STBY) position		X			1/2		
10	APPROACH annunciator comes on and aural warning sounds when vacating old altitude by 1000' for newly selected altitude. System operation normal in (NORM, STBY) position		X					
11	ALTITUDE annunciator came on early or late when approaching selected altitude			X		X		X
12	APPROACH annunciator came on early or late when approaching selected altitude			X		X		X

NOTE

1 For ADC fault isolation, ref. 34-14-00, fault isolation procedure

M1-0003-22-1000

Altitude Alert Fault Matrix
Figure 103 (Sheet 1)

R
R

EFFECTIVITY: ALL

001B

FAULTS — FIM — NO FIM

No.	Problem (Capt or F/O) — Capt. FIRM Codes With -1 / F/O FIRM Codes With -2 / X = Use With Both FIRM Codes	Troubleshooting Faulty LRU: Check FIM ADC	Check FIM FC	Continuity Check or Replace ASP	AWU	BARO	ILCB	FC
	"ALTITUDE ALERT DEVIATION" FAULTS (Ref. Fig. 105)							
15	Aural warning failed to sound when deviating from selected altitude		X		X			
16	DEVIATION annunciator did not flash when deviating from selected altitude		X					
17	Altitude alert annunciator on during selection of new altitude		X	X				
18	DEVIATION annunciators flash during selection of new altitude with air data source knob in NORM (STBY). System operation is normal in other knob position.		X	X				
19	DEVIATION annunciators flash during climb/descent to new altitude with air data source knob in NORM (STBY). System operation is normal in other knob position.		X	X				
20 A	DEVIATION annunciators came on early or late when deviating from selected altitude			X		X		X
	"ALTITUDE ALERT TEST" FAULTS (Ref. Fig. 106)							
20	DEVIATION annunciator did not flash when deviating from selected altitude during test		X					
21	ALTITUDE annunciator did not light at selected altitude during test		X					
22	Altitude alert aural warning failed to sound during approach to selected altitude		X		X			
23	APPROACH annunciator did not light approaching selected altitude during test		X					
24	Altitude select knob jammed or loose			X				

Abbreviations		Remove and Install Ref. Chapt	Page
ADC	Air Data Computer	34-14-01	401
ASP	Altitude Select Panel	22-11-03	401
AWU	Aural Warning Unit	31-22-03	401
BARO	Barometric Altitude Indicator (Servoed)	34-14-03	401
FC	FCES Computer	22-17-01	401
ILCB	Indicator Lights Control Box	33-17-04	401

HOW TO USE

1. Find flight squawk in FAULTS column
2. Check FIM on LRU's listed in FIM column related to FAULTS Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Figure 104 thru 106

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R R Altitude Alert Fault Matrix
Figure 103 (Sheet 2)

EFFECTIVITY: ALL

001B

1 APPROACH ANNUNCIATOR REMAINED ON AT SELECTED ALTITUDE, ALTITUDE ANNUNCIATOR OUT. SYSTEM OPERATION NORMAL IN (NORM, STBY) POSITION

- Replace FCES cmptr (22-17-01).
- If problem persists, reinstall FCES comptr and replace alt sel pnl (22-11-03).
- If problem still persists, replace Capt (F/O) baro alt (34-14-03).

2 ALTITUDE ANNUNCIATOR OUT AT SELECTED ALTITUDE. SYSTEM OPERATION NORMAL IN (NORM, STBY) POSITION

- Replace FCES cmptr (22-17-01).
- If problem persists, reinstall FCES comptr and replace alt sel pnl (22-11-03).
- If problem still persists, replace Capt (F/O) baro alt (34-14-03).

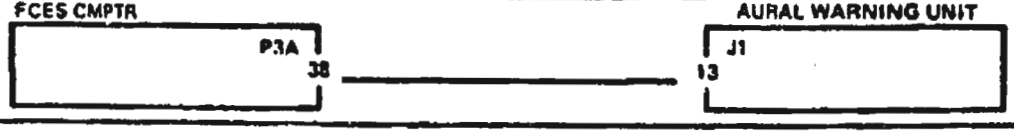
3 ALTITUDE ALERT AURAL WARNING FAILED TO SOUND DURING APPROACH TO SELECTED ALTITUDE

Remove aural warning unit (31-22-03). Connect voltmeter to connector 3318-P2, pin 13. Select scale for +28V reading

Operate altitude select panel and test switch causing ALTITUDE ann to come on. Voltmeter should read +28V for 1/2 second

- Replace aural warning unit with new unit (31-22-03)
- Replace FCES cmptr (22-17-01). If problem persists, chk ckt #1 wiring

CKT NO. 1 AURAL WARNING COMMAND SIGNAL (REF. 22-17-00, SCHEM 4)



4 ALTITUDE ALERT AURAL WARNING FAILED TO SOUND DURING APPROACH TO SELECTED ALTITUDE, ALTITUDE ANNUNCIATOR OUT

- Replace FCES cmptr (22-17-01)

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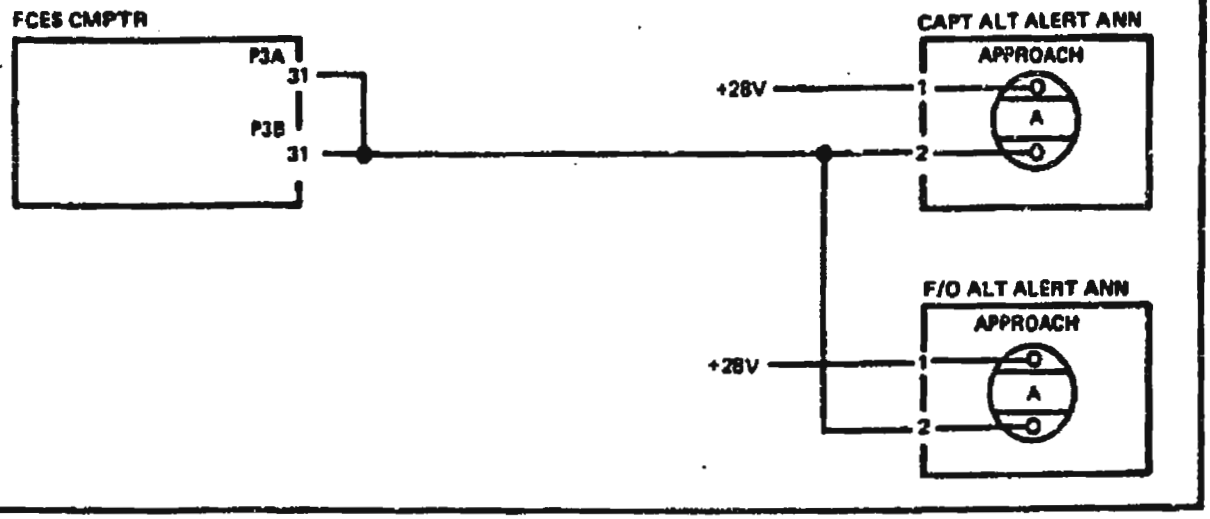
R Altitude Alert Approach Faults
R Figure 104 (Sheet 1)

5	APPROACH ANNUNCIATOR FAILED TO OPERATE WHEN AIRCRAFT APPROACHED SELECTED ALTITUDE

Replace FCES cmptr (22-17-01). If problem persists, chk ckt #1

CKT #1 APPROACH ANNUNCIATOR CIRCUIT (REF. 22-17-00, SCHEM 4)



6	FLAG IN VIEW ON ALT SEL PANEL, NO FLAGS ON BARO ALTIMETERS

Replace FCES cmptr (22-17-01)

7	FLAG IN VIEW ON ALT SEL PANEL AND CAPT OR F/C BARO ALTIMETER

Fault isolate ADC (34-14-00)

8	ALTITUDE SELECT KNOB JAMMED OR LOOSE

Replace altitude select panel (22-11-03)

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R R Altitude Alert Approach Faults
Figure 104 (Sheet 2)

9	APPROACH AND ALTITUDE ANNUNCIATORS FLASH CONTINUOUSLY AT SELECTED ALTITUDE, SYSTEM OPERATION NORMAL IN (NORM, STBY) POSITION

Replace Capt F/O baro ALT (34-14-03). If problem persists, reinstall baro ALT and replace FCES cmptr (22-17-01).

10	APPROACH ANNUNCIATOR COMES ON AND AURAL WARNING SOUNDS WHEN VACATING OLD ALTITUDE BY 1000' FOR NEWLY SELECTED ALTITUDE. SYSTEM OPERATION NORMAL IN (NORM, STBY) POSITION

Replace FCES cmptr (22-17-01)

11	BOTH DEVIATION ANNUNCIATORS CAME ON EARLY OR LATE WHEN APPROACHING SELECTED ALTITUDE

Replace in following order:
- FCES cmptr (22-17-01).
- Altitude select pnl (22-11-03).
- Capt, F/O baro ALT (34-14-03).

12	BOTH ALTITUDE ANNUNCIATORS CAME ON EARLY OR LATE WHEN APPROACHING SELECTED ALTITUDE

Replace in following order:
- FCES cmptr (22-17-01).
- Altitude select pnl (22-11-03).
- Capt, F/O baro ALT (34-14-03).

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R R Altitude Alert Approach Faults
Figure 104 (Sheet 3)

EFFECTIVITY: ALL

0018

15 AURAL WARNING FAILED TO SOUND WHEN DEVIATING FROM SELECTED ALTITUDE

Remove aural warning unit (31-22-03). Connect voltmeter to connector 3318-P2, pin 13. Select scale for +28V reading

Operate altitude select panel and test switch causing ALTITUDE snn to come on. Voltmeter should read +28V for 1/2 second

+28V ok: Replace aural warning unit with new unit (31-22-03)

+28V not ok: Replace FCES cmptr (22-17-01). If problem persists, chk ckt #1 wiring

CKT #1 AURAL WARNING COMMAND SIGNAL (REF. 22-17-00, SCHEM. 4)

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Altitude Alert Deviation Faults
Figure 105 (Sheet 1)

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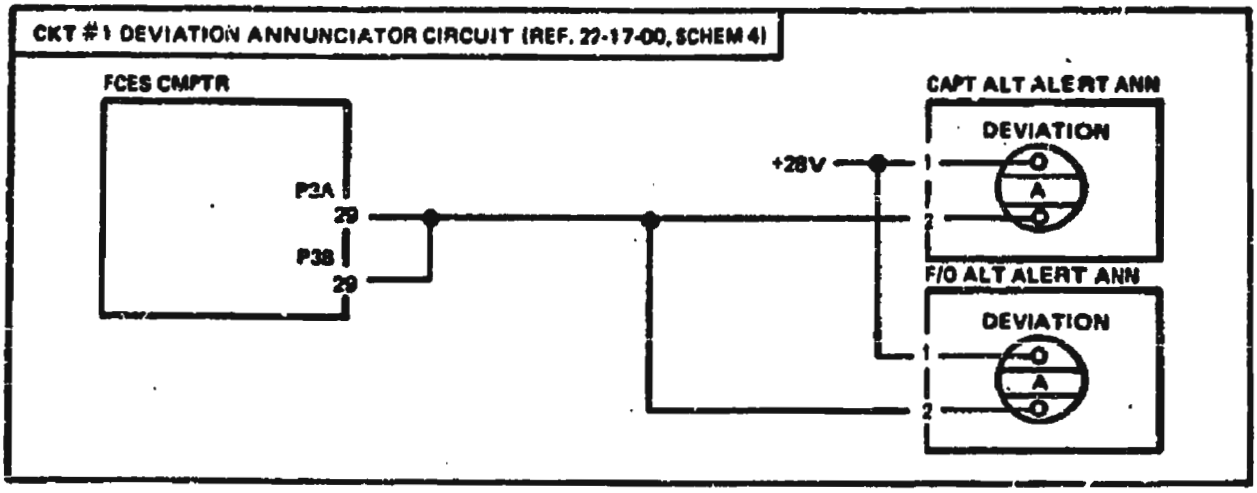
EFFECTIVITY: ALL

001B

16	DEVIATION ANNUNCIATOR DID NOT FLASH WHEN DEVIATING FROM SELECTED ALTITUDE

Replace FCES cmptr (22-17-01). If problem persists, chk ckt # 1



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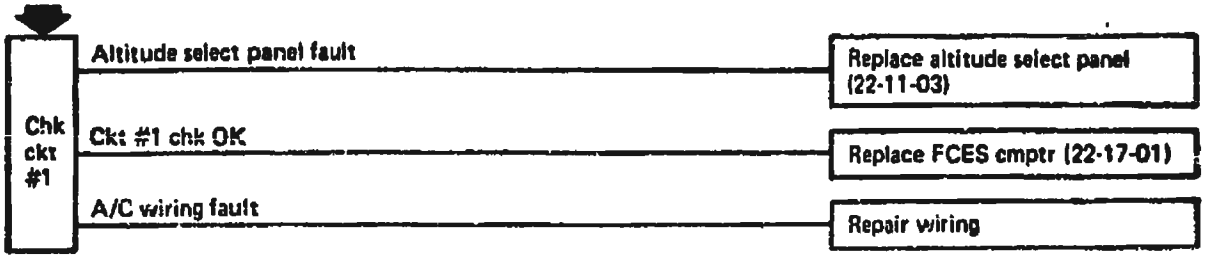
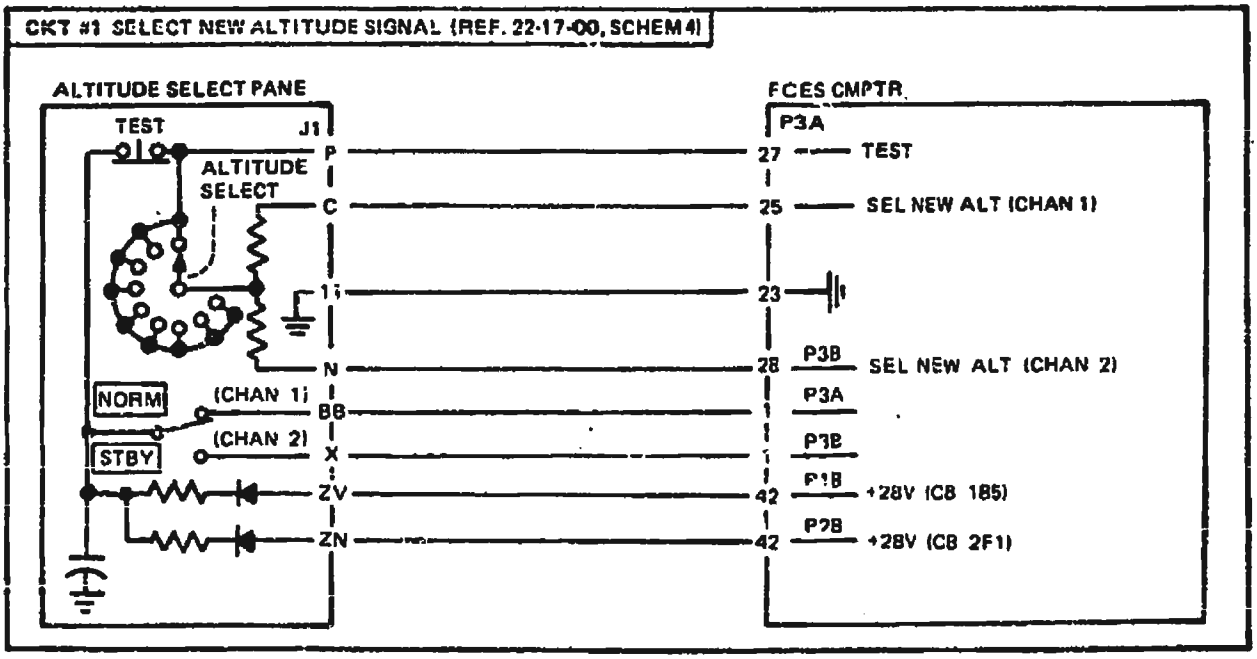
Altitude Alert Deviation Faults
Figure 105 (Sheet 2)

EFFECTIVITY: ALL

0018

17	ALTITUDE ANNUNCIATOR ON WHILE SELECTING NEW ALTITUDE
18	DEVIATION ANNUNCIATORS FLASH DURING SELECTION OF NEW ALTITUDE WITH AIR DATA SOURCE KNOB IN NORM (STBY) POSITION. SYSTEM OPERATION IS NORMAL IN OTHER KNOB POSITION.
19	DEVIATION ANNUNCIATORS FLASH DURING CLIMB/DESCENT TO NEW ALTITUDE WITH AIR DATA SOURCE KNOB IN NORM (STBY) POSITION. SYSTEM OPERATION IS NORMAL IN OTHER KNOB POSITION.





20A	AURAL WARNING OR DEVIATION ANNUNCIATOR CAME ON EARLY OR LATE WHEN DEVIATING FROM SELECTED ALTITUDE

Replace in following order:
- FCES Cmptr (22-17-01).
- Altitude select pnl (22-11-03).
- Capt, F/O baro ALT (34-14-03).

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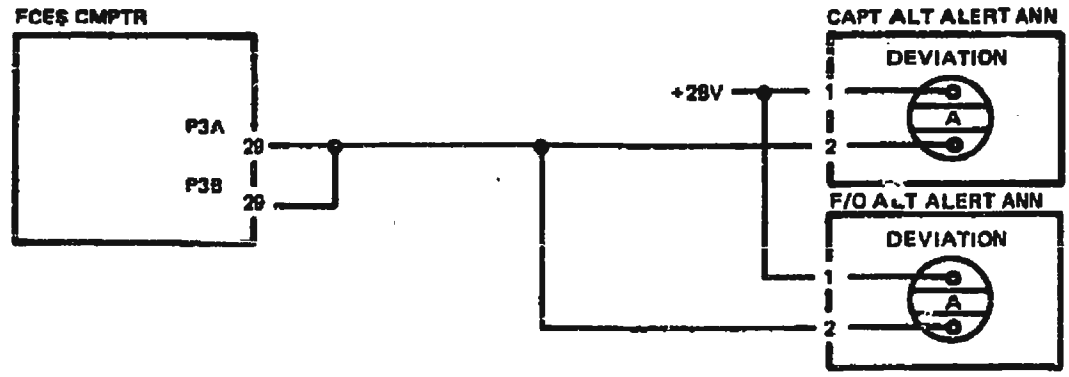
R Altitude Alert Deviation Faults
R Figure 105 (Sheet 3)

20 DEVIATION ANNUNCIATOR DID NOT FLASH WHEN DEVIATING FROM SELECTED ALTITUDE DURING TEST

Replace FCES cmptr (22-17-01). If problem persists, chk ckt #1

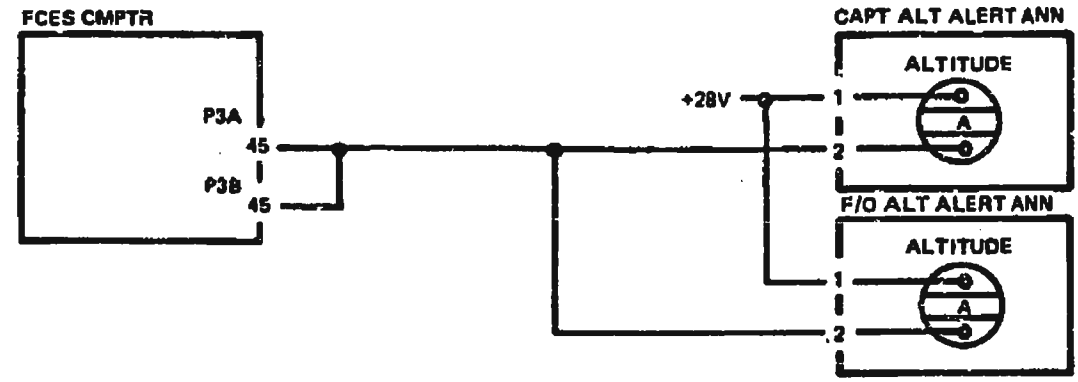
CKT #1 DEVIATION ANNUNCIATOR CIRCUIT (REF. 22-17-00, SCHEM 1)



21 ALTITUDE ANNUNCIATOR DID NOT LIGHT AT SELECTED ALTITUDE DURING TEST

Replace FCES cmptr (22-17-01). If problem persists, chk ckt #1

CKT #1 ALTITUDE ANNUNCIATOR CIRCUIT (REF. 22-17-00, SCHEM 1)



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R Altitude Alert Test Faults
R Figure 106 (Sheet 1)

R EFFECTIVITY: ALL

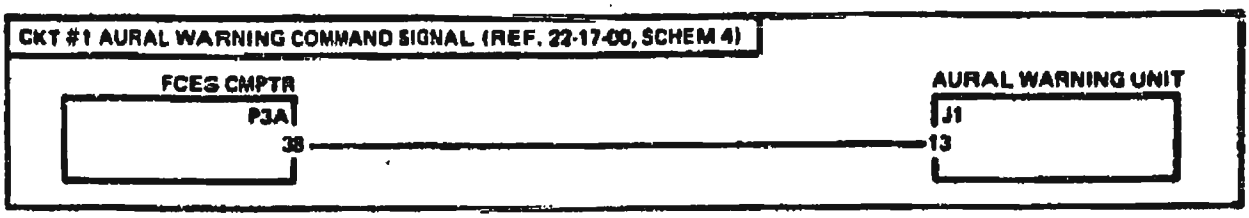
22 ALTITUDE ALERT AURAL WARNING FAILED TO SOUND DURING APPROACH TO SELECTED ALTITUDE

Remove aural warning unit (31-22-03). Connect voltmeter to connector 3318-P2, pin 13. Select scale for +28V reading

Operate altitude select panel and TEST switch causing ALTITUDE ann to come on. Voltmeter should read +28V for 1/2 second

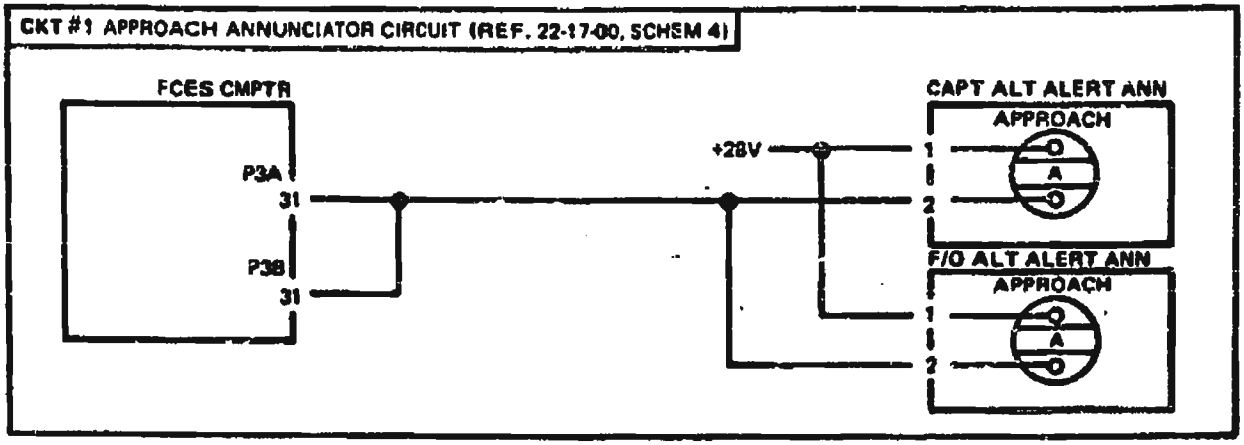
+28V ok → Replace aural warning unit with new unit (31-22-03)

+28V not ok → Replace FCES cmptr (22-17-01). If problem persists, chk ckt # 1 wiring



23 APPROACH ANNUNCIATOR DID NOT LIGHT APPROACHING SELECTED ALTITUDE DURING TEST

Replace FCES cmptr (22-17-01). If problem persists, chk ckt # 1



24 ALTITUDE SELECT KNOB JAMMED OR LOOSE

Replace altitude select panel (22-11-03)

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R Altitude Alert Test Faults
R Figure 106 (Sheet 2)

EFFECTIVITY: ALL

001B

DIRECT LIFT CONTROL/AUTOMATIC GROUND SPOILER - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting Direct Lift Control/Automatic Ground Spoiler (DLC/AGS) faults are included in this section of the manual. A DLC/AGS malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use DLC/AGS Fault Matrix.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

2. Fault Isolation Identification

Table 101 is a list of the Direct Lift Control/Automatic Ground Spoiler fault isolation diagrams and schematics. Figure 101 and 102 provide component location for DLC/AGS troubleshooting.

A. General

Direct lift control/automatic ground spoiler fault isolation contains two levels of troubleshooting, fault oriented and system oriented.

(1) Fault oriented fault isolation (Ref. Paragraph 2B) troubleshoots a specitic DLC/AGS problem. System oriented fault isolation (Ref. 22-17-07, Table 501) tests and troubleshoots the DLC/AGS system.

B. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the DLC/AGS system by a specific fault number. It also identifies and locates the LRU that can cause the problem For faults not listed in Figure 103, perform System Oriented Fault Isolation in 22-17-07, Table 501 to isolate problem.

Figures 104, and 105 provide diagnostic steps to further isolate the fault. The diagnostic steps are in flow chart form which contain complete fault isolation procedures for each fault. Action instructions are contained within the flow chart blocks while monitored results of the actions are outside the blocks. When using the flow charts, it is assumed that systems are in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

Autoflight fault isolation procedures do not contain PREREQUISITES. Instead, when uncertainty exists regarding setup and circuit breaker information, reference should be made to the sub-system Adjustment and Test procedure (22-17-07, page 501).

Table 101

	FIGURE	TITLE
	101	Component Location Index
	102	Component Locator Diagram
	103	DLC/AGS System Fault Matrix
	104	DLC Faults
R	105	AGS Faults

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCESSORY UNIT – AFCS/MLG	1	FESC, CTR RACK/112AB	22-10-11
BOX – PROXIMITY SWITCH	1	MESC/192K	31-22-01
BOX – PROXIMITY SWITCH LOGIC	1	MESC/192K	31-22-02
COMPUTER – FLIGHT CONTROL ELECTRONICS SYSTEM	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER – SPEED CONTROL	1	FESC, CTR RACK/112AB	22-31-07
SENSOR – MLG AIR/GROUND SAFETY	2	MLG	32-63-01
SENSOR – MLG TRUCK UNLEVEL POSITION	4	MLG	32-61-08
SENSOR – NLG AIR/GROUND SAFETY	1	NLG	32-63-02
SERVO – DIRECT LIFT CONTROL	1	HSC, AFT CTR/147AB	27-61-06
SWITCH – MLG HYDRAULIC PRESSURE	2	HSC/147AB	32-31-15
SWITCH – SPEED BRAKE AUTO DISABLE	1	FLT STA, ON SPEED BRAKE CONTROL LEVER	2761-S1
SWITCH – THROTTLE CONTROL	3	FESC, FWD OVHD/112AB	76-11-05

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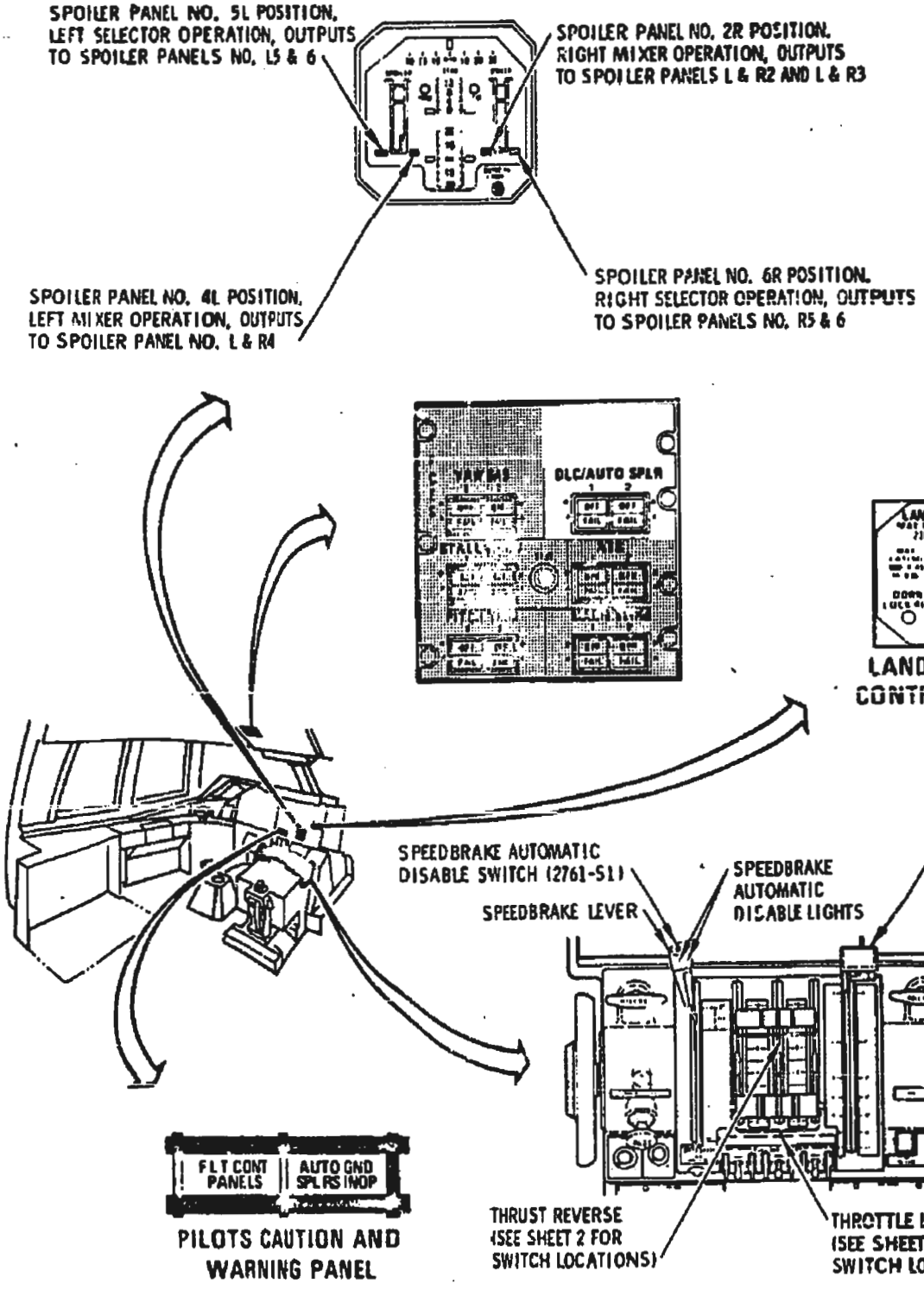
R Component Location Index
R Figure 101


SPOILER PANEL NO. 5L POSITION, LEFT SELECTOR OPERATION, OUTPUTS TO SPOILER PANELS NO. L5 & 6
SPOILER PANEL NO. 2R POSITION, RIGHT MIXER OPERATION, OUTPUTS TO SPOILER PANELS L & R2 AND L & R3
SPOILER PANEL NO. 4L POSITION, LEFT MIXER OPERATION, OUTPUTS TO SPOILER PANEL NO. L & R4
SPOILER PANEL NO. 6R POSITION, RIGHT SELECTOR OPERATION, OUTPUTS TO SPOILER PANELS NO. R5 & 6
YAW DAS
DLC/AUTO SPLR
LANDING GEAR
LANDING GEAR CONTROL SWITCH
SPEEDBRAKE AUTOMATIC DISABLE SWITCH (2761-51)
SPEEDBRAKE LEVER
SPEEDBRAKE AUTOMATIC DISABLE LIGHTS
FLAP LEVER (SEE SHEET 2 FOR SWITCH LOCATIONS)
FLT CONT PANELS
AUTO GND SPLRS INOP
PILOTS CAUTION AND WARNING PANEL
THRUST REVERSE (SEE SHEET 2 FOR SWITCH LOCATIONS)
THROTTLE LEVERS (SEE SHEET 2 FOR SWITCH LOCATIONS)

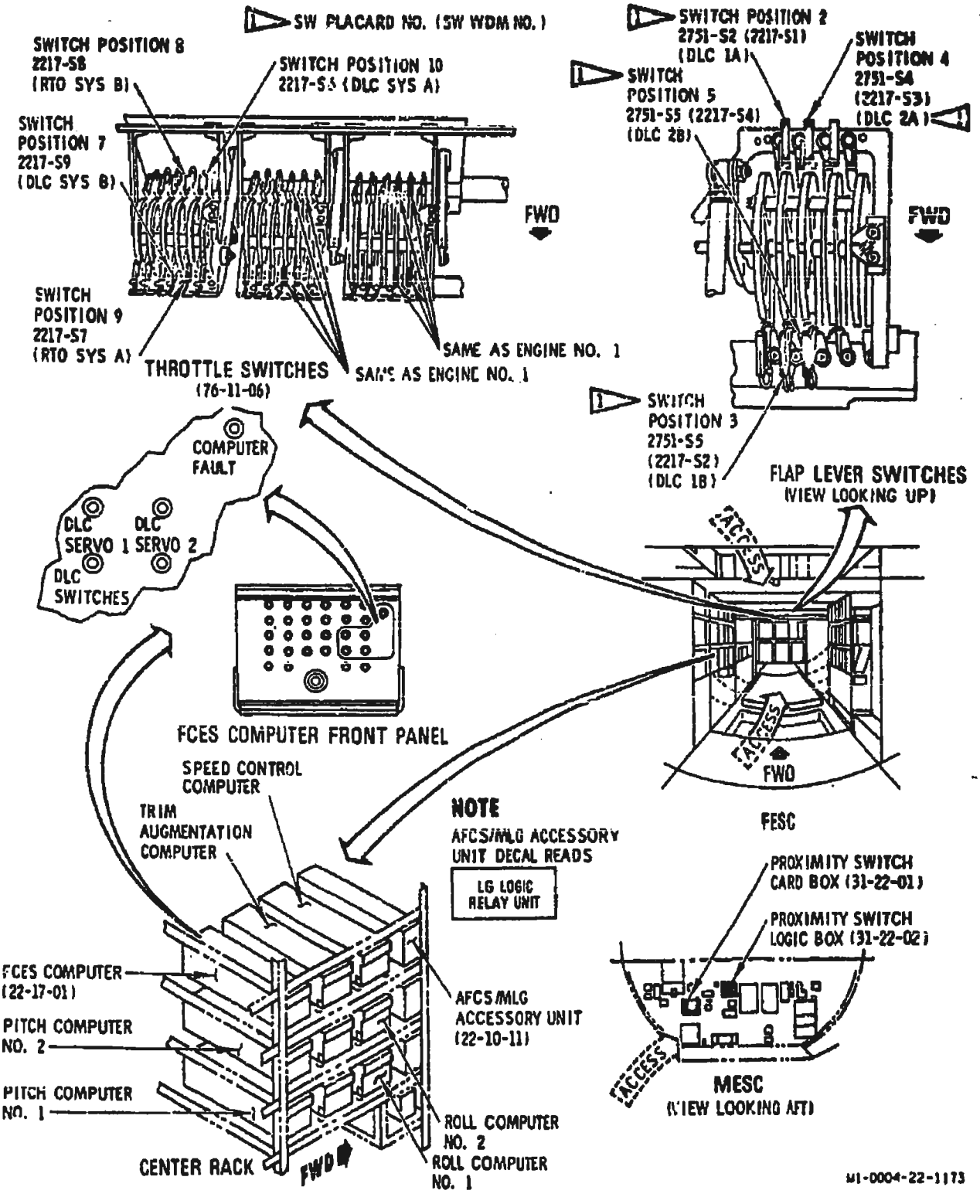
M1-0001-22-1171

R
R

Component Locator Diagram
Figure 102 (Sheet 1)

EFFECTIVITY: ALL

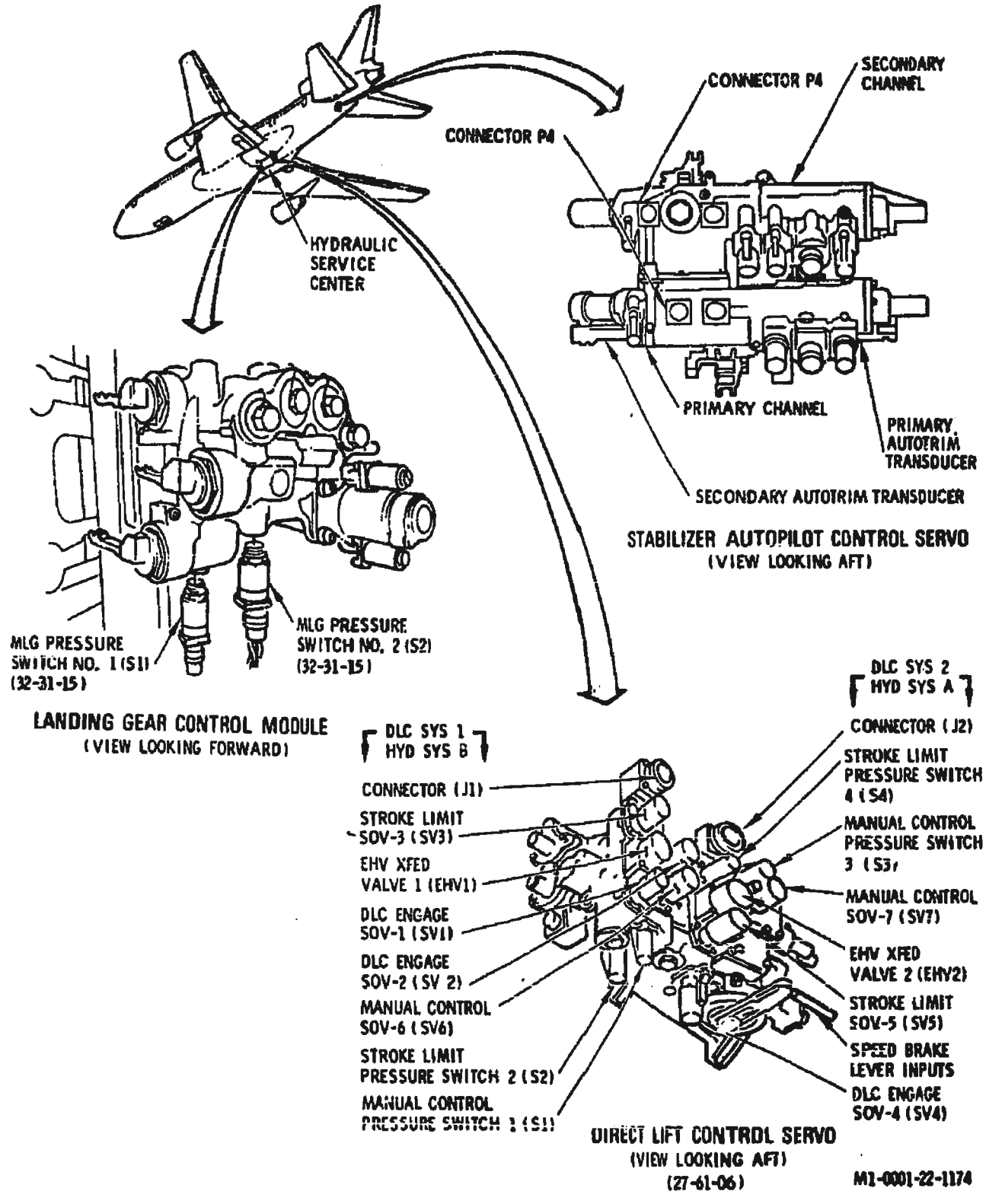
001B



R Component Locator Diagram
R Figure 102 (Sheet 2)

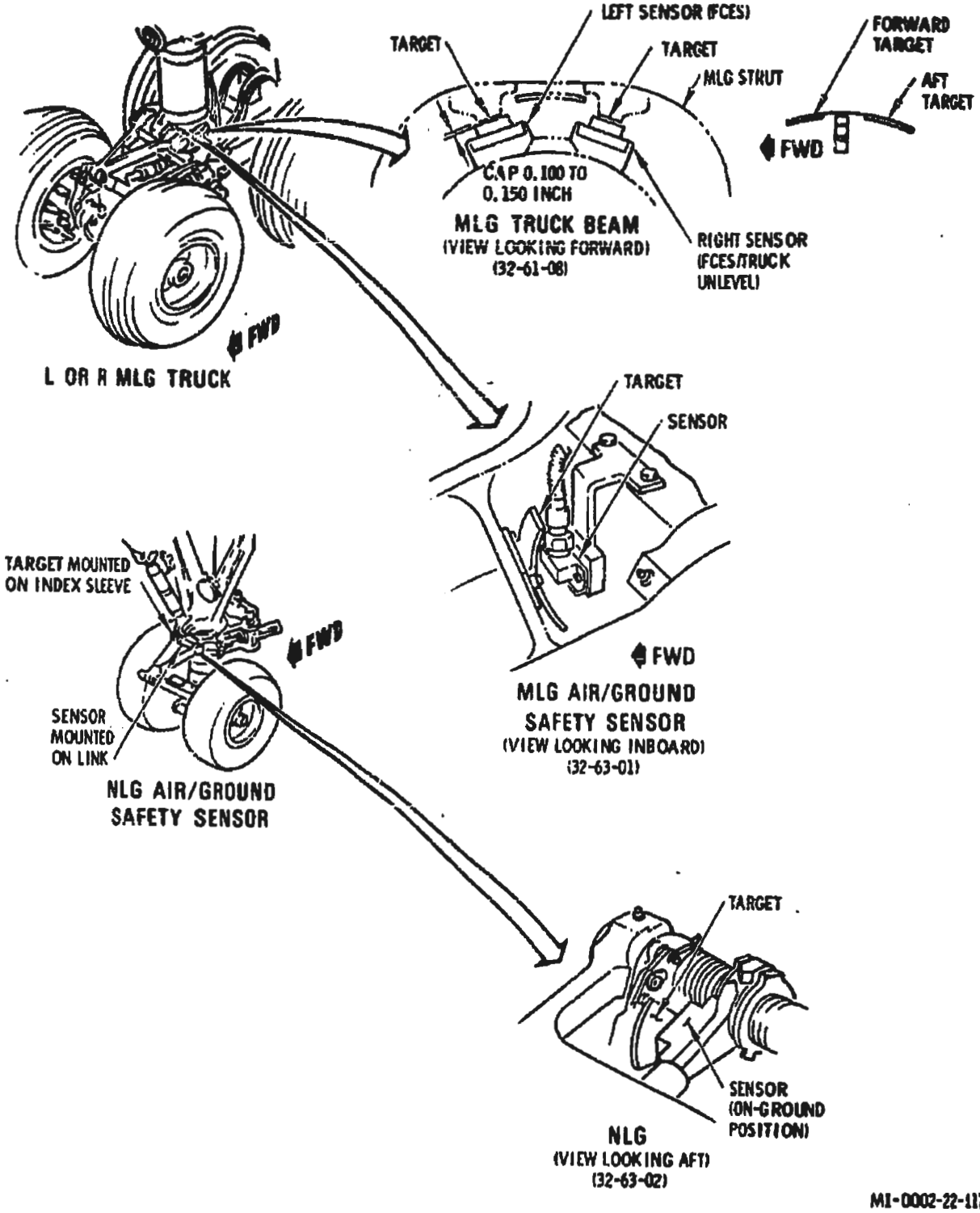
EFFECTIVITY: ALL

001B



R Component Locator Diagram
R Figure 102 (Sheet 3)

EFFECTIVITY: ALL



MI-0002-22-1175

R Component Locator Diagram
R Figure 102 (Sheet 4)

EFFECTIVITY: ALL

0018

FAULTS — FIM — NO FIM

No.	Problem (Capt or F/O)	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr													Continuity Check or Replace								
		AIR/GRD	AOA	C PRESS SW	DLC S	EHV	FC	FLAP CONT SW	LG CS	MLG AGSS	MLG TRUCK	NLG AGSS	TAC	THROT CONT SW	DLC SERVO PRESS SW	FCES CP	ILCB CARD	PROX CARD BOX	PROX LOGIC BOX	SOV	SPEED BL	HYD FUSE	SPD CONT CMPTR
	Capt FIRM Codes With -1 / F/O FIRM Codes With -2; X = Use With Both FIRM Codes														①					②			
	"DLC" FAULTS (REF. FIG. 104)																						
1	AUTO GND SPLRS INOP ann on, DLC operation normal	X		X			X		X	X	X	X						X	X			X	
2	DLC/AUTO SPLR (1, 2) FAIL light on, will not reset in flight when 33 degrees flaps selected, all other indications and DLC operation normal				X		X						X		X	X				X	X		X
3	DLC/AUTO SPLR (1, 2) FAIL light and associated STALL WARN FAIL, PITCH and ROLL PFCS MONITOR FAIL lights on. DLC operation normal						X																
4	DLC failed to operate, all FAIL lights out						X																
5	DLC failed to operate, DLC/AUTO SPLR 1 and 2 FAIL lights on and AUTO GND SPLRS INOP ann on				X		X				X												
6	Speed brake automatic disable light(s) on speed brake handle remain on, cycled switch to no effect. DLC (did, did not) operate																				X		
7	DLC failed to operate, both DLC/AUTO SPLR FAIL and both STALL WARN FAIL lights on						X																
8	DLC failed to operate, cycled DLC/AUTO SPLR switches off and on but could not reset, both STALL WARN FAIL lights were also on						X																

NOTE

① DLC-1 = PRESSURE SWITCH NO.2
DLC-2 = PRESSURE SWITCH NO.4

② DLC-1 = SOLENOID VALVE NO.3
DLC-2 = SOLENOID VALVE NO.5

MI-0002-22-4242

R DLC/AGS System Fault Matrix
R Figure 103 (Sheet 1)

FAULTS — FIM — NO FIM

No.	Problem (Capt or F/O)	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: AIR/GRD	AOA	C PRESS SW	DLC S	EHV	FC	FLAP CONT SW	LG CS	MLG AGSS	MLG TRUCK	NLG AGSS	TAC	THROT CONT SW	Continuity Check or Replace: DLC SERVO PRESS SW	FCES CP	ILCB CARD	PROX CARD BOX	PROX LOGIC BOX	SOV	SPEED BL
	Capt FIRM Codes With -1 / F/O FIRM Codes With -2 / X Use With Both FIRM Codes																				
"AGS" Faults (Ref. Fig. 106)																					
10	No AGS after landing, all FAIL lights out						X														
11	Both DLC/AUTO SPLR FAIL lights came on after touchdown, both main gears touched together. AGS inop ON	X								X		X							X	X	
12	Both DLC/AUTO SPLR FAIL lights came on at touchdown, the left main gear touched down first. AGS inop ON	X								X	X								X	X	
13	Both DLC/AUTO SPLR FAIL lights came on at touchdown, the right main gear touched down first. AGS inop ON	X								X	X								X	X	
14	Both DLC/AUTO SPLR FAIL lights came on during rollout, all other indications normal. AGS inop ON	X								X	X	X							X	X	
15	AUTO GND SPLRS INOP annunciator came on during approach, DLC operation normal. Both DLC/AUTO SPLR FAIL lights came on at toughdown	X		X			X		X												
16	Spoilers failed to operate during rejected takeoff. There were no AGS FAIL lights						X							X							
17	Spoilers failed to operate during rejected takeoff, AUTO GND SPLRS INOP annunciator came on. No other FAIL indications	X		X			X		X												
18	Spoilers failed to operate during rejected takeoff. AUTO GND SPLRS INOP annunciator and (1, 2, both) DLC/AUTO SPLR FAIL lights on	X		X			X			X	X	X							X	X	
19	AUTO GND SPLRS INOP annunciator came on after takeoff	X		X			X			X	X	X							X	X	
20	One DLC/AUTO-SPLR FAIL light come on at touchdown	X																			

M1-0003-22-1276

R DLC/AGS System Fault Matrix
R Figure 103 (Sheet 2)

Abbreviations		Remove and Install Ref.	
		Chapt	Page
AIR/GRD	AFCS/MLG Accessory Unit	22-10-11	401
AOA	Angle of Attack Sensor	22-31-06	401
C PRESS SW	MLG Hydraulic Pressure Switch	32-31-15	401
DLC PRESS SW	Pressure Switch	27-61-36	401
DLC S	Direct Lift Control Servo	27-61-06	401
EHV-1, EHV-2	Electrohydraulic Servo Valve	27-61-07	401
FC	FCES Computer	22-17-01	401
FCES CP	FCES Control Panel	22-10-07	401
FLAP CONT SW	Flap Control Switches	27-51-55	401
ILCB CARD	Indicator Lights Control Box, Card	33-17-04	401
LG CS	Landing Gear Control Switch	32-31-14	401
MLG AGSS	Main Landing Gear Air/Ground Safety Sensor	32-63-01	401
MLG TRUCK	Main Landing Gear Inboard/Outboard Sensors	32-61-08	401
NLG AGSS	Nose Landing Gear Air/Ground Safety Sensor	32-63-02	401
PROX CARD BOX	Proximity Switch Card Box, Card	31-22-01	401
PROX LOGIC BOX	Proximity Switch Logic Box, Card	31-22-02	401
SOV-1 THRU SOV-5	Solenoid Shutoff Valve	27-61-08	401
SPEED BL	Speed Brake Lever (Switch, Lights)	27-61-01	401
TAC	Trim Augmentation Computer	22-18-01	401
THROT CONT SW	Throttle Control Switches	76-11-06	401

HOW TO USE

1. Find flight squawk in FAULTS Column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 or 105

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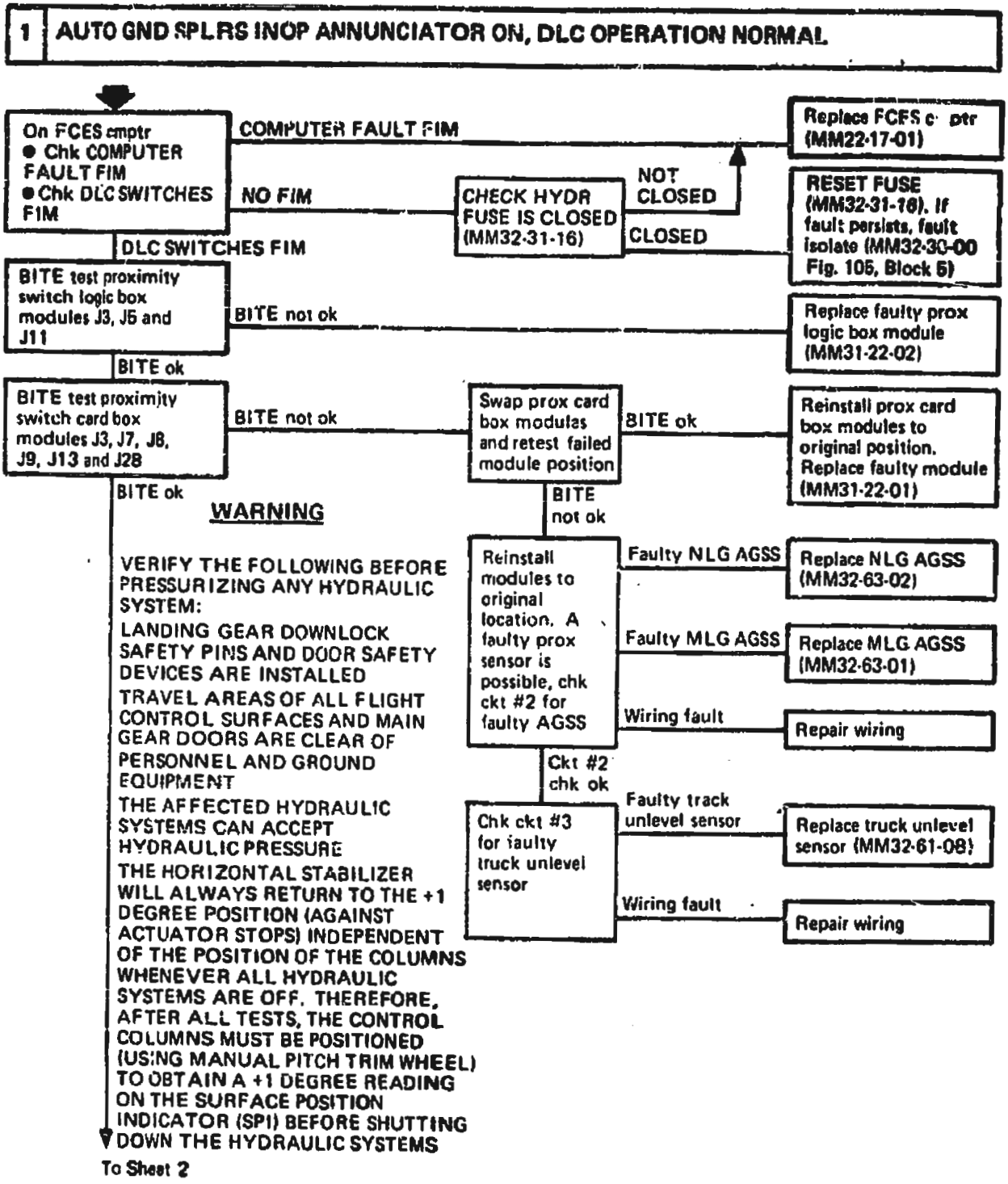
DLC/AGS System Fault Matrix
Figure 103 (Sheet 3)


1 AUTO GND SPLRS INOP ANNUNCIATOR ON, DLC OPERATION NORMAL
On FCES cmptr
● Chk COMPUTER FAULT FIM
● Chk DLC SWITCHES FIM
COMPUTER FAULT FIM
Replace FCES c ptr (MM22-17-01)
NO FIM
CHECK HYDR FUSE IS CLOSED (MM32-31-16)
NOT CLOSED
CLOSED
RESET FUSE (MM32-31-16). If fault persists, fault isolate (MM32-30-00 Fig. 105, Block 5)
DLC SWITCHES FIM
BITE test proximity switch logic box modules J3, J5 and J11
BITE not ok
Replace faulty prox logic box module (MM31-22-02)
BITE ok
BITE test proximity switch card box modules J3, J7, J8, J9, J13 and J28
BITE not ok
Swap prox card box modules and retest failed module position
BITE ok
Reinstall prox card box modules to original position. Replace faulty module (MM31-22-01)
BITE ok
BITE not ok
WARNING
VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:
LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED
TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT
THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE
THE HORIZONTAL STABILIZER WILL ALWAYS RETURN TO THE +1 DEGREE POSITION (AGAINST ACTUATOR STOPS) INDEPENDENT OF THE POSITION OF THE COLUMNS WHENEVER ALL HYDRAULIC SYSTEMS ARE OFF. THEREFORE, AFTER ALL TESTS, THE CONTROL COLUMNS MUST BE POSITIONED (USING MANUAL PITCH TRIM WHEEL) TO OBTAIN A +1 DEGREE READING ON THE SURFACE POSITION INDICATOR (SPI) BEFORE SHUTTING DOWN THE HYDRAULIC SYSTEMS
Reinstall modules to original location. A faulty prox sensor is possible, chk ckt #2 for faulty AGSS
Faulty NLG AGSS
Replace NLG AGSS (MM32-63-02)
Faulty MLG AGSS
Replace MLG AGSS (MM32-63-01)
Wiring fault
Repair wiring
Ckt #2 chk ok
Chk ckt #3 for faulty truck unlevel sensor
Faulty track unlevel sensor
Replace truck unlevel sensor (MM32-61-08)
Wiring fault
Repair wiring
To Sheet 2

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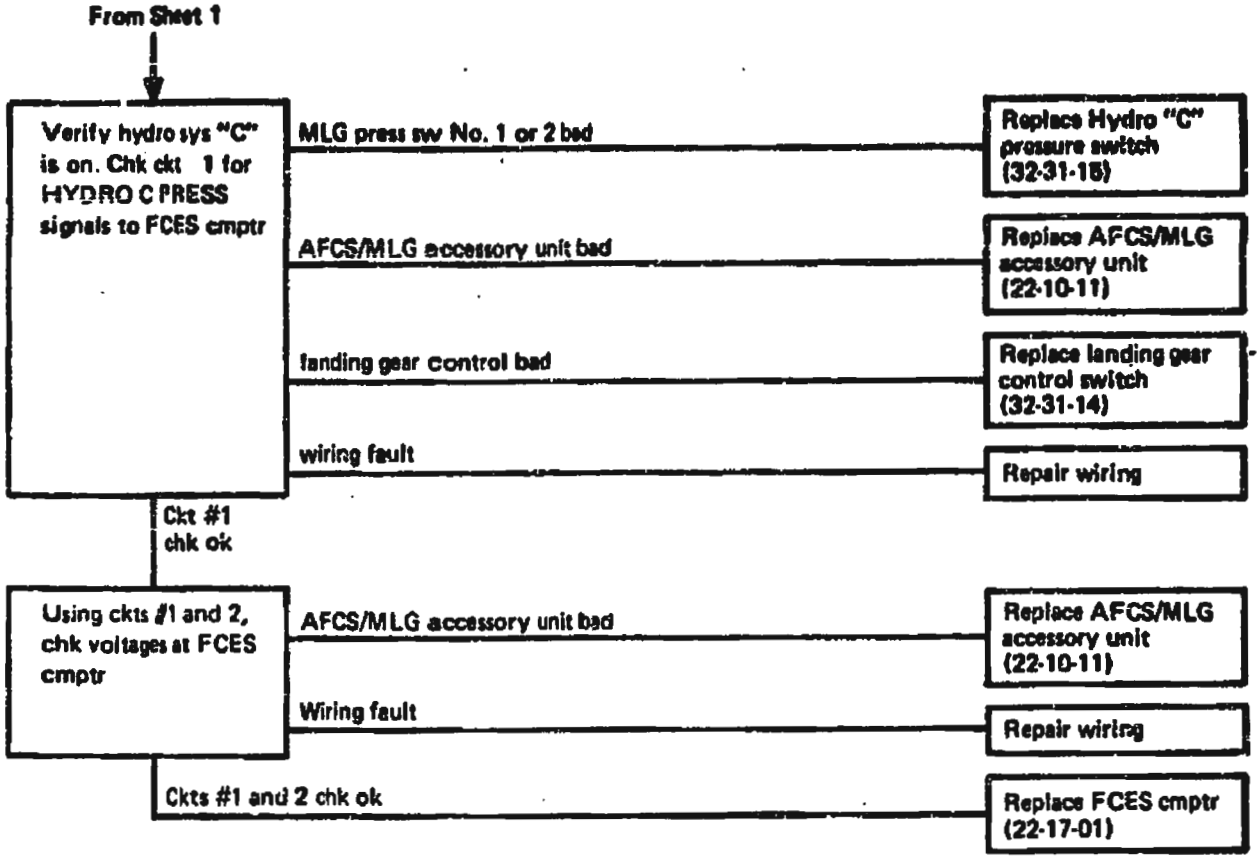
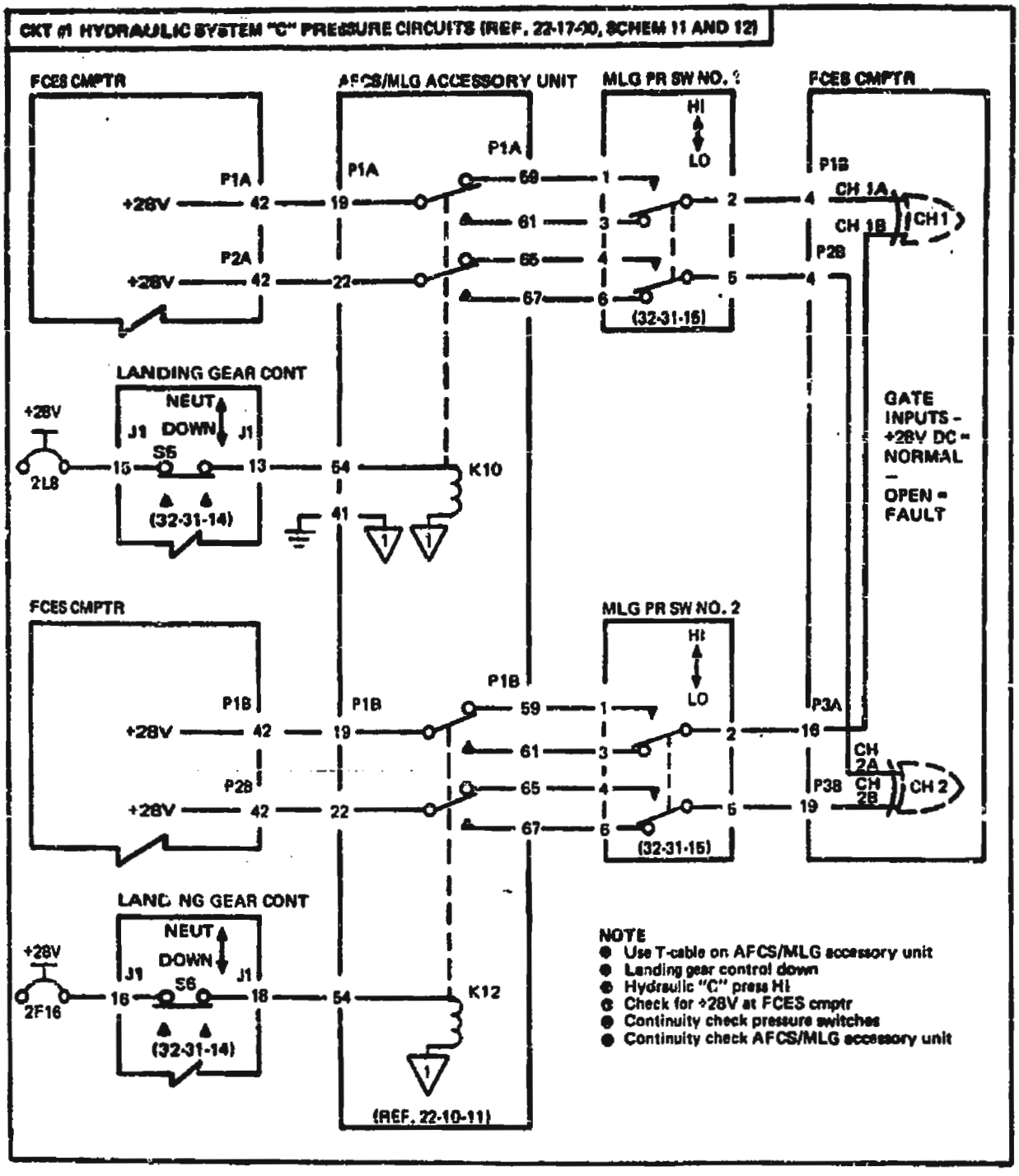
DLC Faults
Figure 104 (Sheet 1)


From Sheet 1
Verify hydro sys "C" is on. Chk ckt 1 for HYDRO C PRESS signals to FCES cmptr
MLG press sw No. 1 or 2 bad
Replace Hydro "C" pressure switch (32-31-15)
AFCS/MLG accessory unit bad
Replace AFCS/MLG accessory unit (22-10-11)
landing gear control bad
Replace landing gear control switch (32-31-14)
wiring fault
Repair wiring
Ckt #1 chk ok
Using ckts #1 and 2, chk voltages at FCES cmptr
AFCS/MLG accessory unit bad
Replace AFCS/MLG accessory unit (22-10-11)
Wiring fault
Repair wiring
Ckts #1 and 2 chk ok
Replace FCES cmptr (22-17-01)

M1-0100-22-1260

DLC Faults
Figure 104 (Sheet 2)

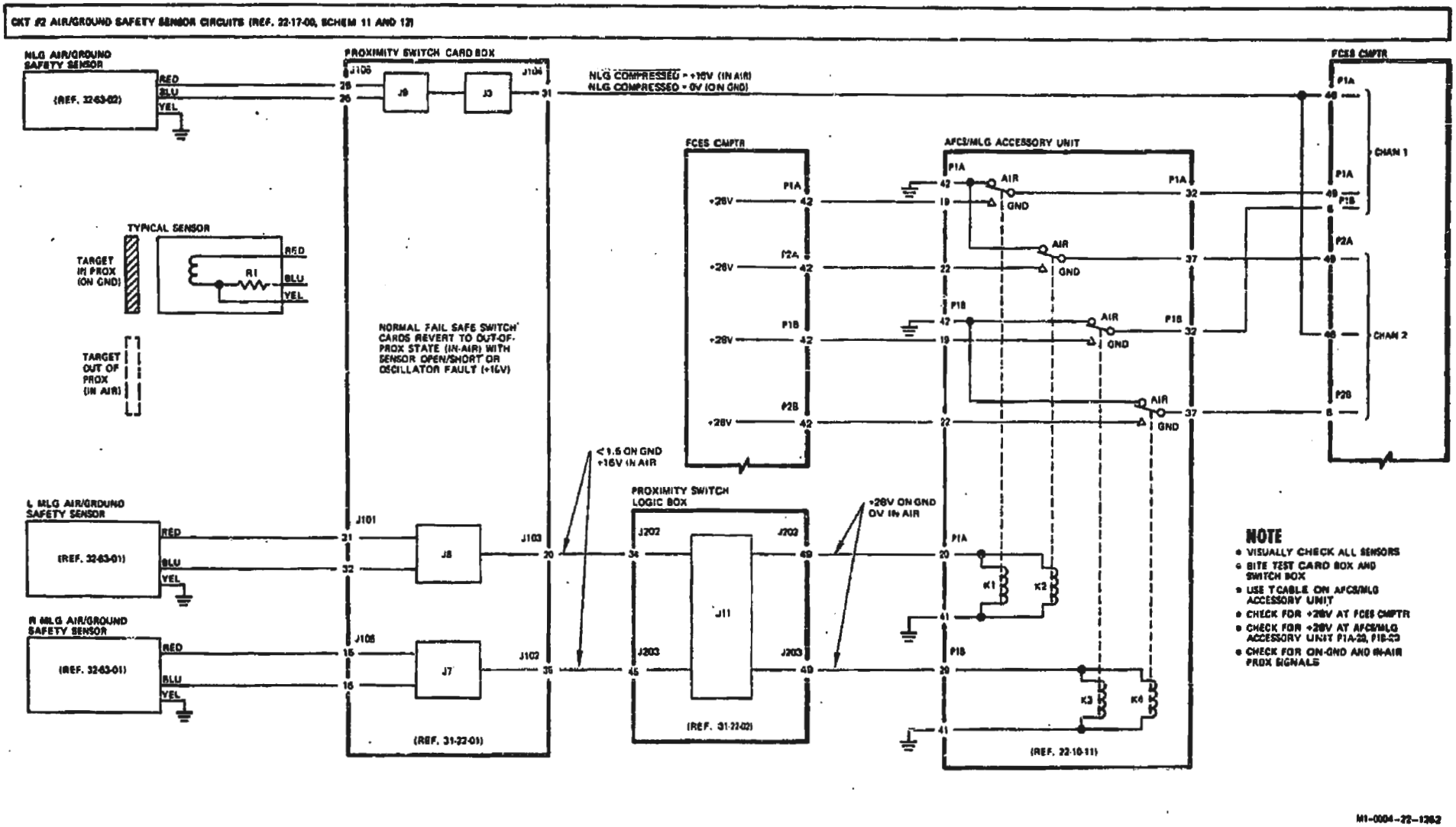


M1-0003-22-1261

DLC Faults
Figure 104 (Sheet 3)

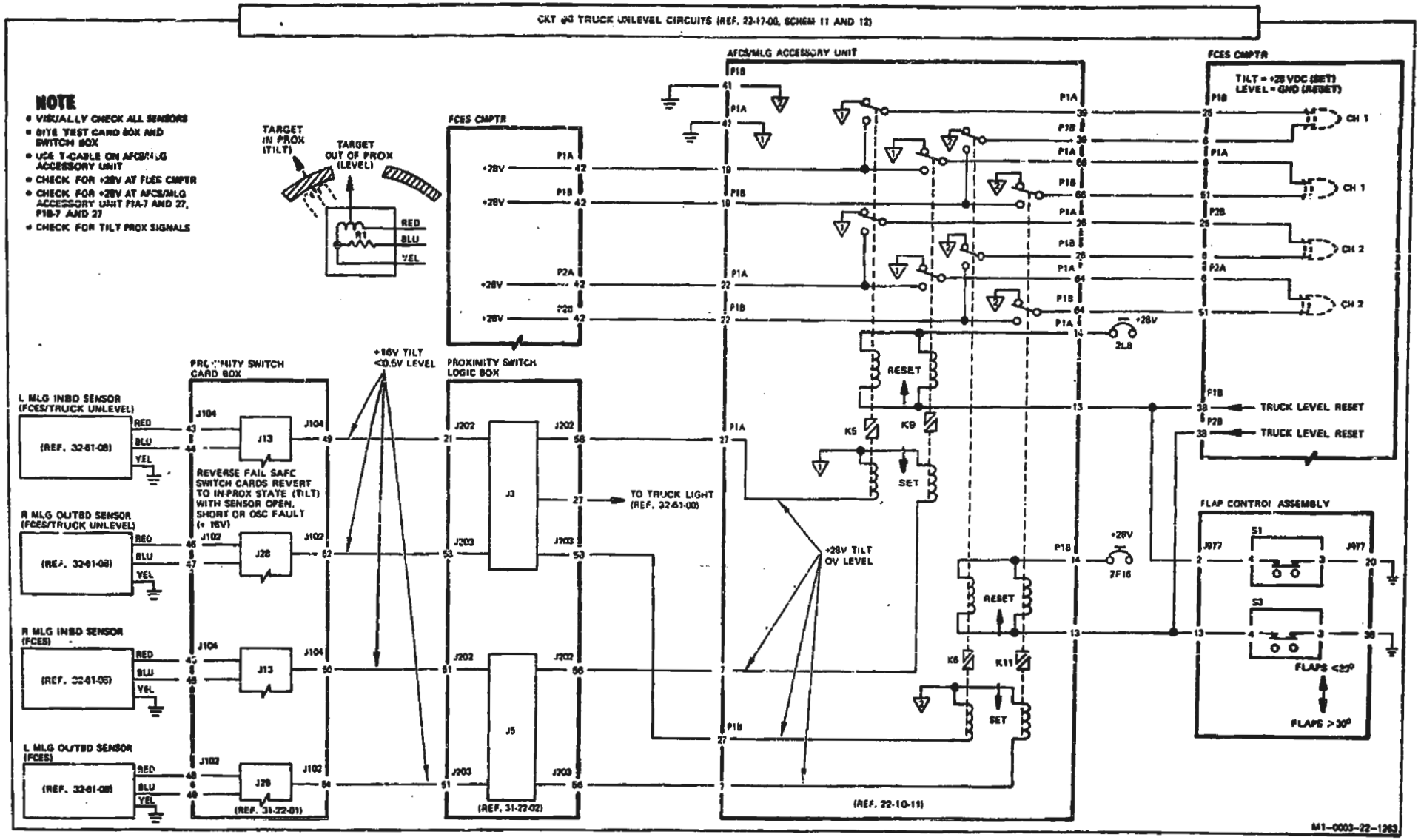
R
R
001B

EFFECTIVITY: ALL

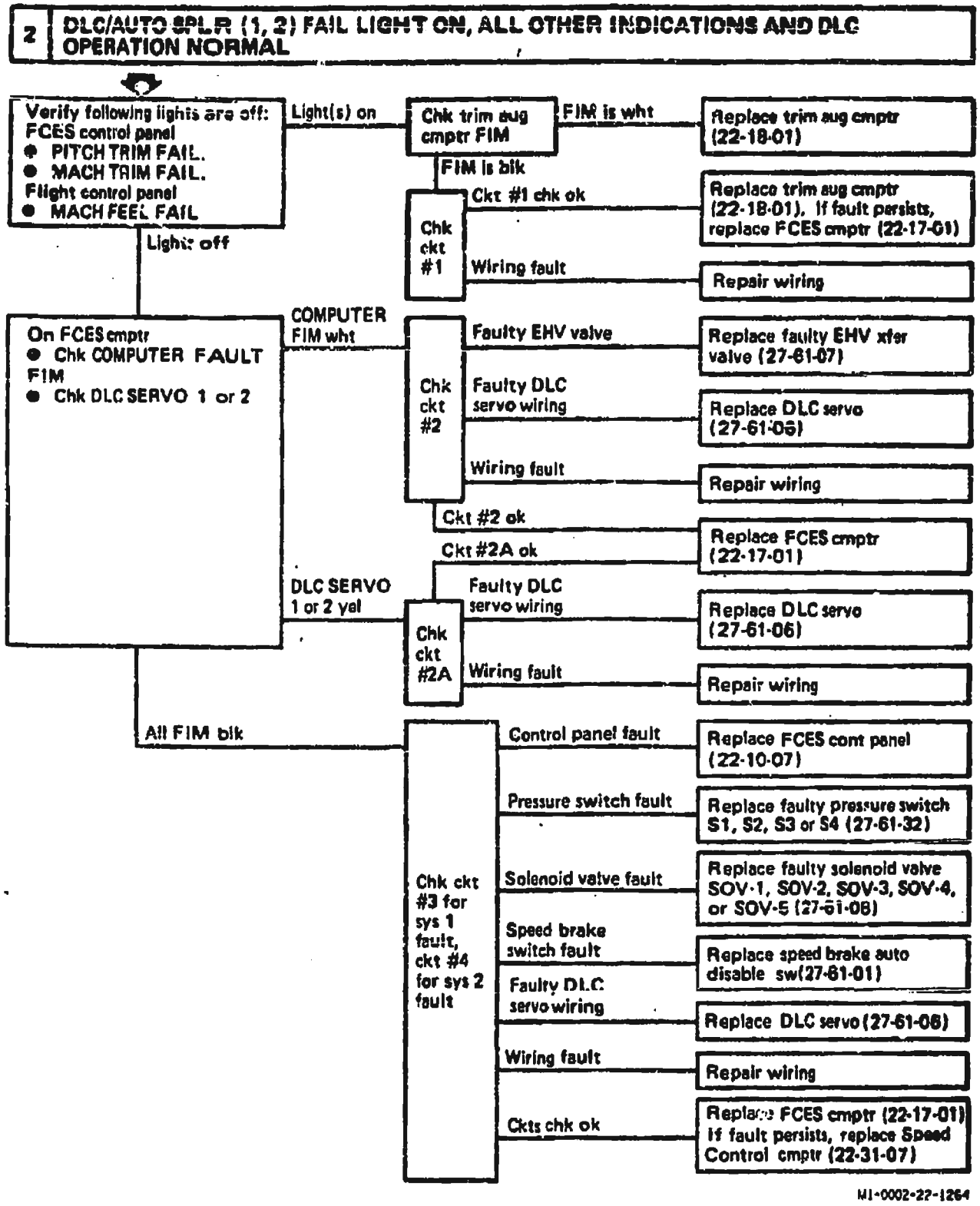


DLC Faults
Figure 104 (Sheet 4)

R
R
0018 EFFECTIVITY: ALL


CKT #3 TRUCK UNLEVEL CIRCUITS (REF. 22-17-00, SCHEM 11 AND 12)
NOTE
• VISUALLY CHECK ALL SENSORS
• BITE TEST CARD BOX AND SWITCH BOX
• USE T-CABLE ON AFCS/MLG ACCESSORY UNIT
• CHECK FOR +28V AT FCES CMPTR
• CHECK FOR +28V AT AFCS/MLG ACCESSORY UNIT P1A-7 AND 27, P1B-7 AND 27
• CHECK FOR TILT PROX SIGNALS
TARGET IN PROX (TILT)
TARGET OUT OF PROX (LEVEL)
AFCS/MLG ACCESSORY UNIT
FCES CMPTR
TILT = +28 VDC (SET)
LEVEL = GND (RESET)
PROXIMITY SWITCH CARD BOX
PROXIMITY SWITCH LOGIC BOX
+16V TILT
<0.5V LEVEL
+28V TILT
>7V LEVEL
L MLG INBD SENSOR (FCES/TRUCK UNLEVEL)
R MLG OUTBD SENSOR (FCES/TRUCK UNLEVEL)
R MLG INBD SENSOR (FCES)
L MLG OUTBD SENSOR (FCES)
REVERSE FAIL SAFE SWITCH CARDS REVERT TO IN-PROX STATE (TILT) WITH SENSOR OPEN, SHORT OR OSC FAULT (+ 16V)
TO TRUCK LIGHT (REF. 32-61-00)
RESET
SET
K5
K9
K6
K11
TRUCK LEVEL RESET
FLAP CONTROL ASSEMBLY
FLAPS <25°
FLAPS >30°
(REF. 22-10-11)
(REF. 31-22-01)
(REF. 31-22-02)
M1-0003-22-1263

DLC Faults
Figure 104 (Sheet 5)

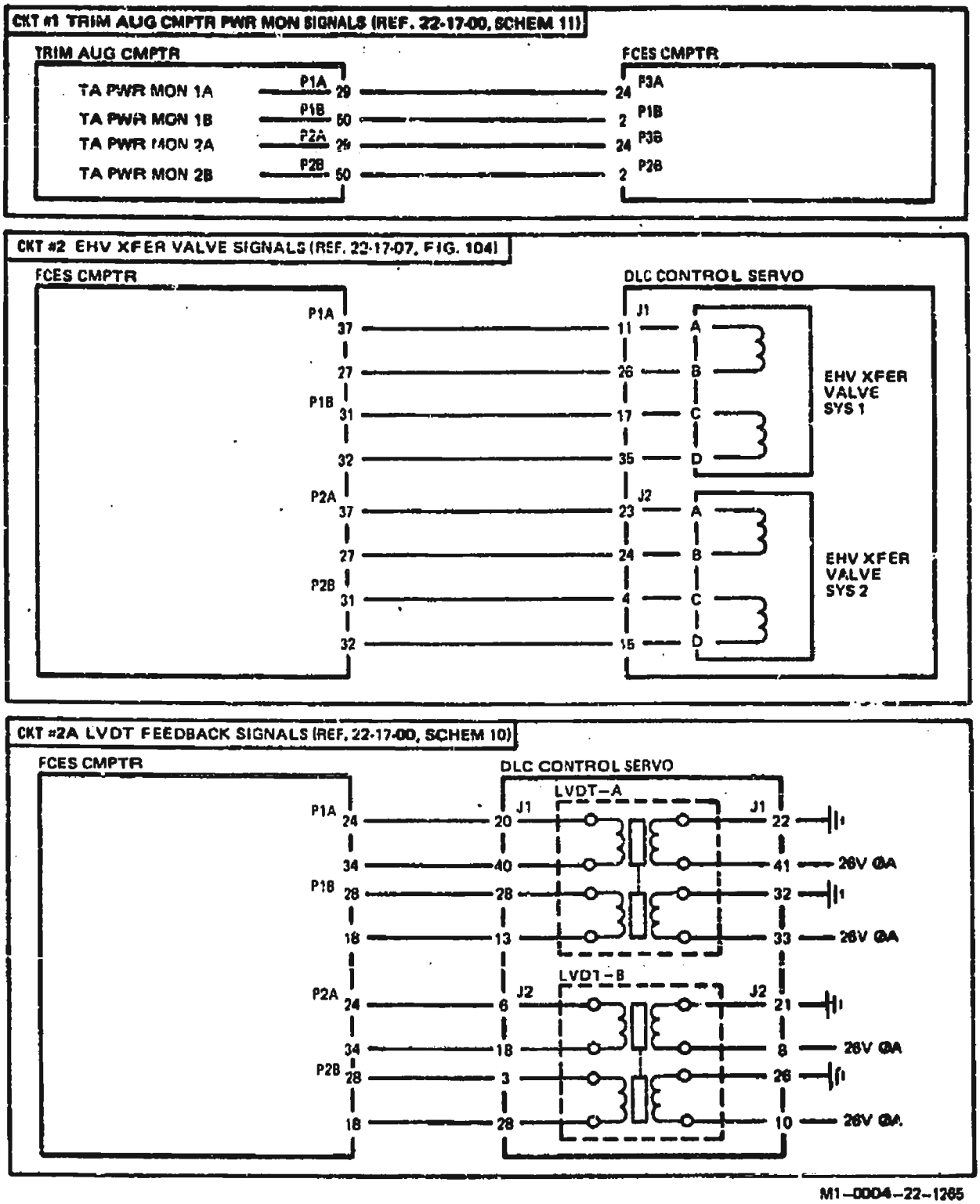

2 DLC/AUTO SPLR (1, 2) FAIL LIGHT ON, ALL OTHER INDICATIONS AND DLC OPERATION NORMAL
Verify following lights are off:
FCES control panel
PITCH TRIM FAIL.
MACH TRIM FAIL.
Flight control panel
MACH FEEL FAIL
Light(s) on
Chk trim aug cmptr FIM
FIM is wht
Replace trim aug cmptr (22-18-01)
FIM is blk
Chk ckt #1
Ckt #1 chk ok
Replace trim aug cmptr (22-18-01). If fault persists, replace FCES cmptr (22-17-01)
Wiring fault
Repair wiring
Light: off
On FCES cmptr
Chk COMPUTER FAULT FIM
Chk DLC SERVO 1 or 2
COMPUTER FIM wht
Chk ckt #2
Faulty EHV valve
Replace faulty EHV xfer valve (27-61-07)
Faulty DLC servo wiring
Replace DLC servo (27-61-06)
Wiring fault
Repair wiring
Ckt #2 ok
Replace FCES cmptr (22-17-01)
Ckt #2A ok
DLC SERVO 1 or 2 yel
Chk ckt #2A
Faulty DLC servo wiring
Replace DLC servo (27-61-06)
Wiring fault
Repair wiring
All FIM blk
Chk ckt #3 for sys 1 fault, ckt #4 for sys 2 fault
Control panel fault
Replace FCES cont panel (22-10-07)
Pressure switch fault
Replace faulty pressure switch S1, S2, S3 or S4 (27-61-32)
Solenoid valve fault
Replace faulty solenoid valve SOV-1, SOV-2, SOV-3, SOV-4, or SOV-5 (27-61-08)
Speed brake switch fault
Replace speed brake auto disable sw(27-61-01)
Faulty DLC servo wiring
Replace DLC servo (27-61-06)
Wiring fault
Repair wiring
Ckts chk ok
Replace FCES cmptr (22-17-01) If fault persists, replace Speed Control cmptr (22-31-07)
MI-0002-22-1264

R
R

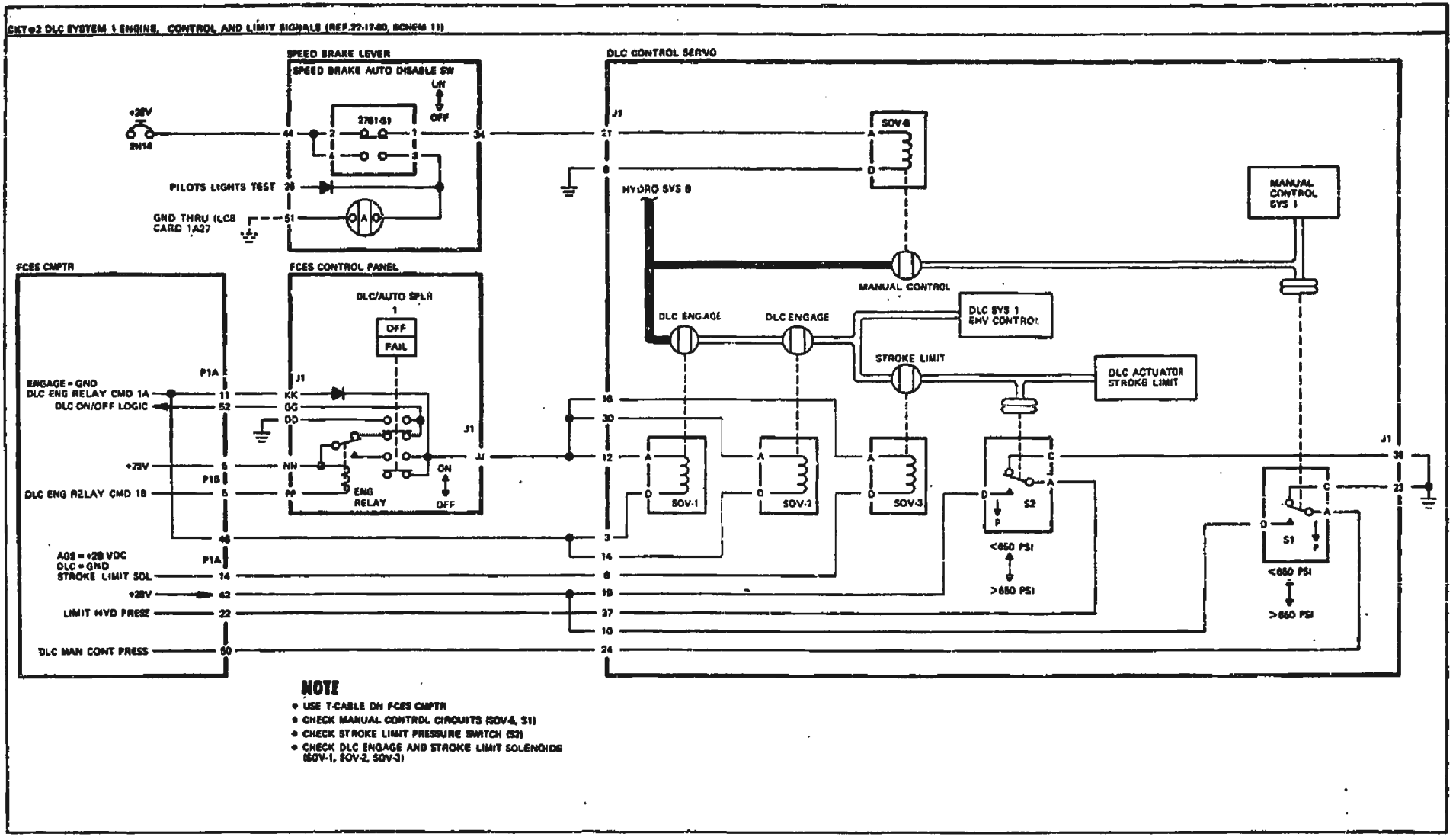
DLC Faults
Figure 104 (Sheet 6)

EFFECTIVITY: ALL

001B



DLC Faults
Figure 104 (Sheet 7)



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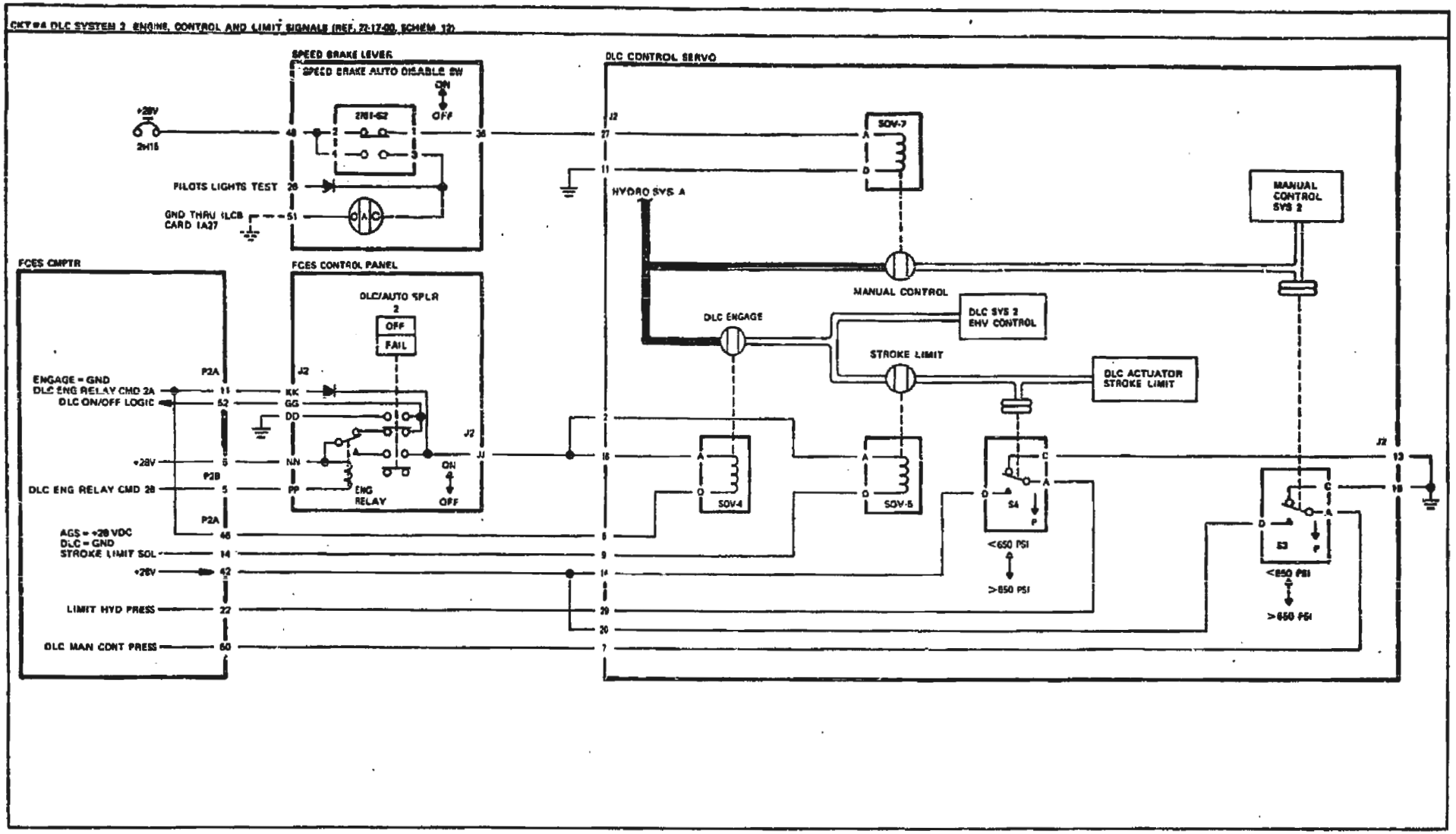
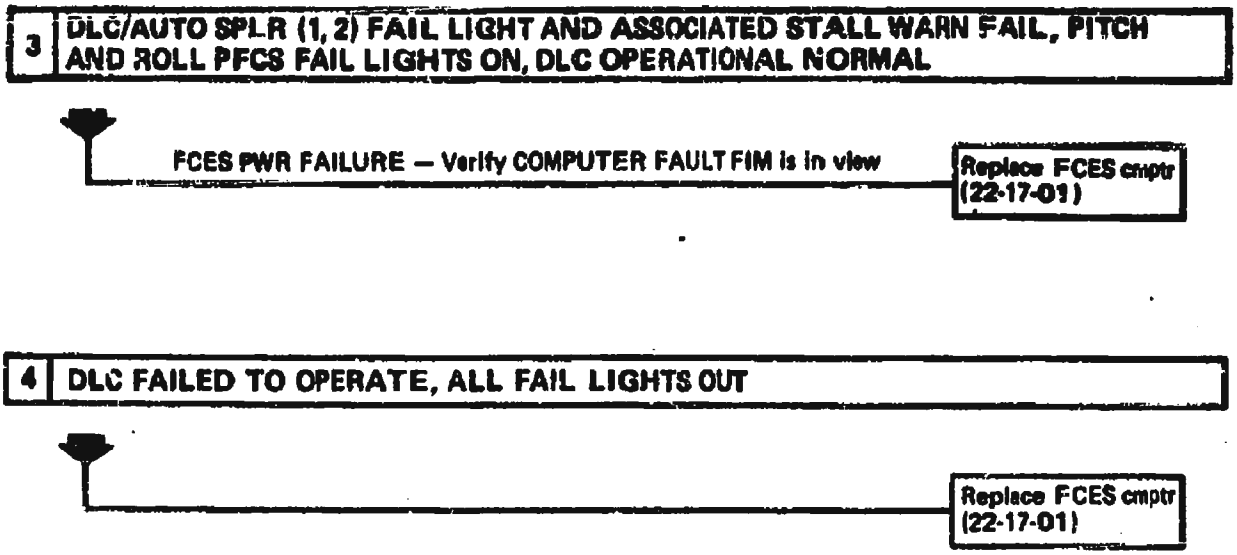
DLC Faults
Figure 104 (Sheet 8)

R EFFECTIVITY: ALL
R
001B



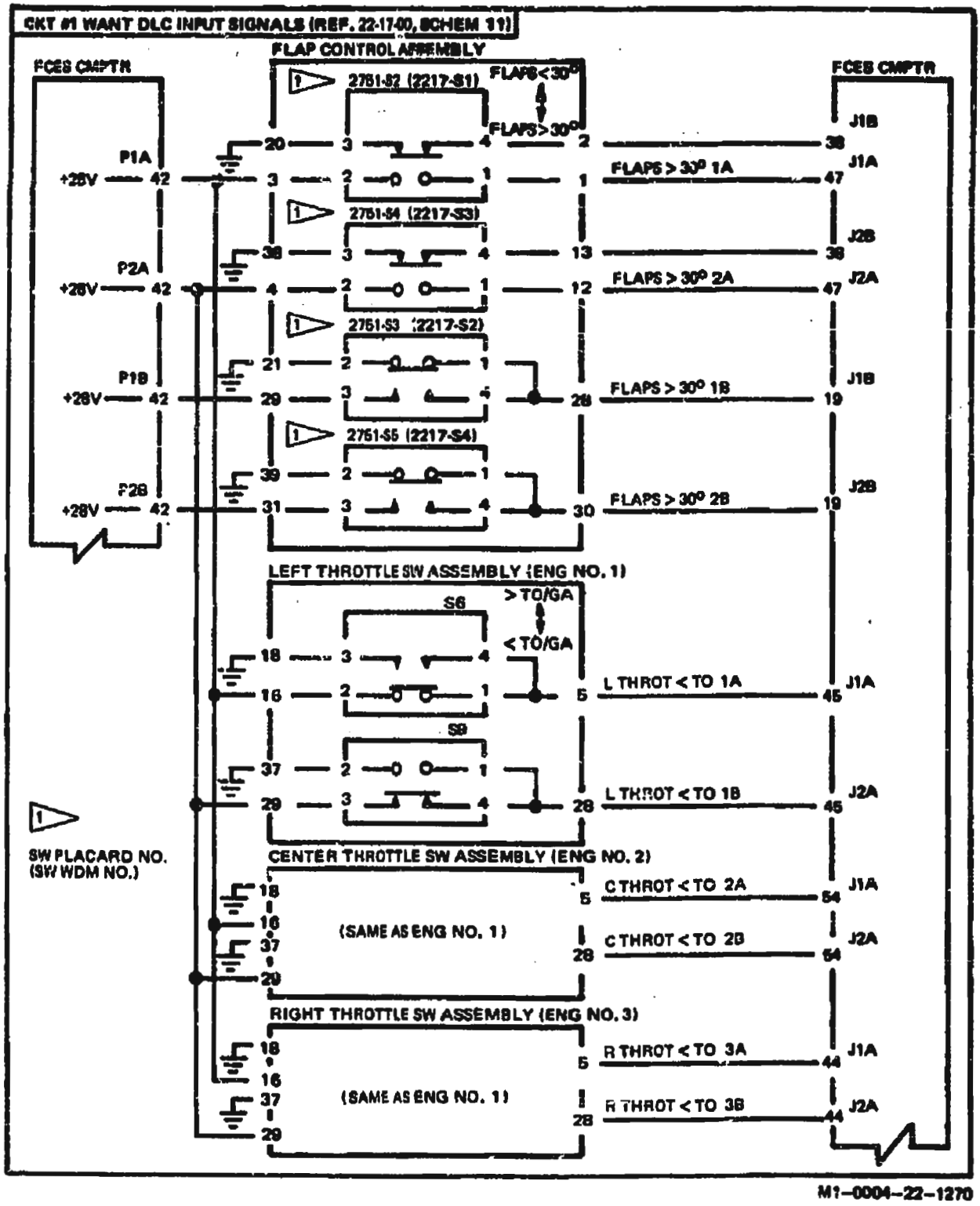
DLC Faults
Figure 104 (Sheet 9)


3
DLC/AUTO SPLR (1, 2) FAIL LIGHT AND ASSOCIATED STALL WARN FAIL, PITCH AND ROLL PFCS FAIL LIGHTS ON, DLC OPERATIONAL NORMAL
FCES PWR FAILURE — Verify COMPUTER FAULT FIM is in view
Replace FCES cmptr (22-17-01)
4
DLC FAILED TO OPERATE, ALL FAIL LIGHTS OUT
Replace FCES cmptr (22-17-01)

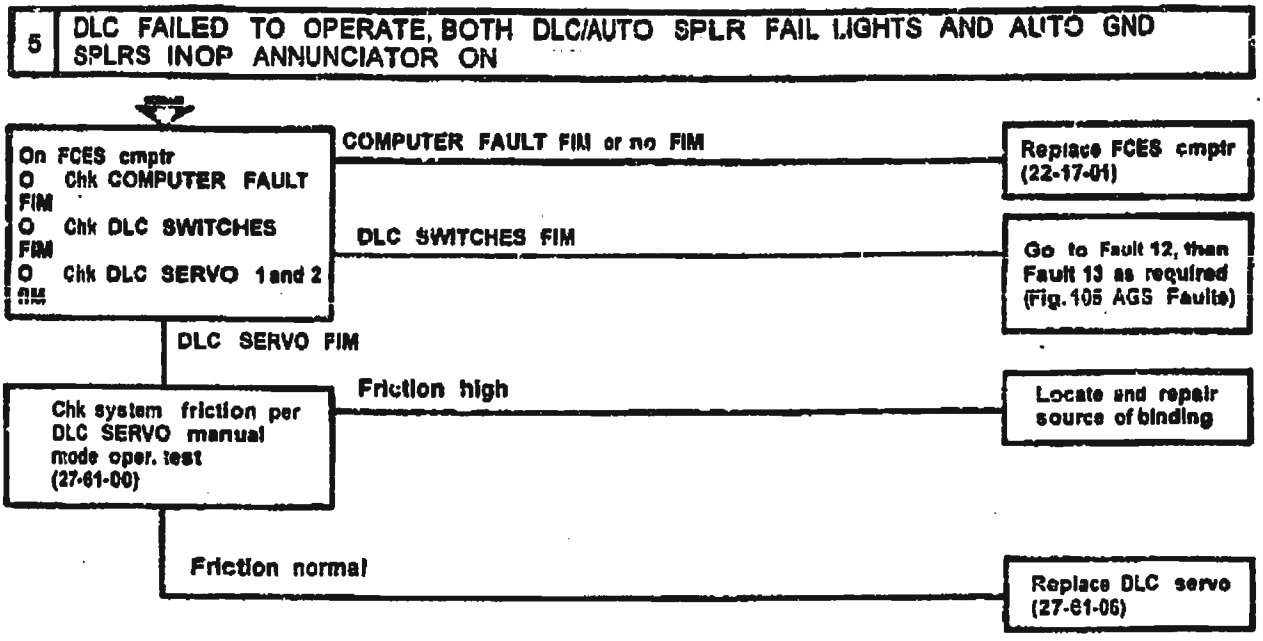
M1—0002—22—1268

DLC Faults
Figure 104 (Sheet 10)

R EFFECTIVITY: ALL
R
001B



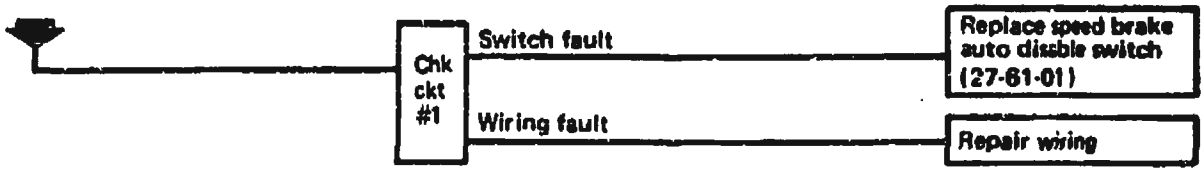
DLC Faults
Figure 104 (Sheet 11)

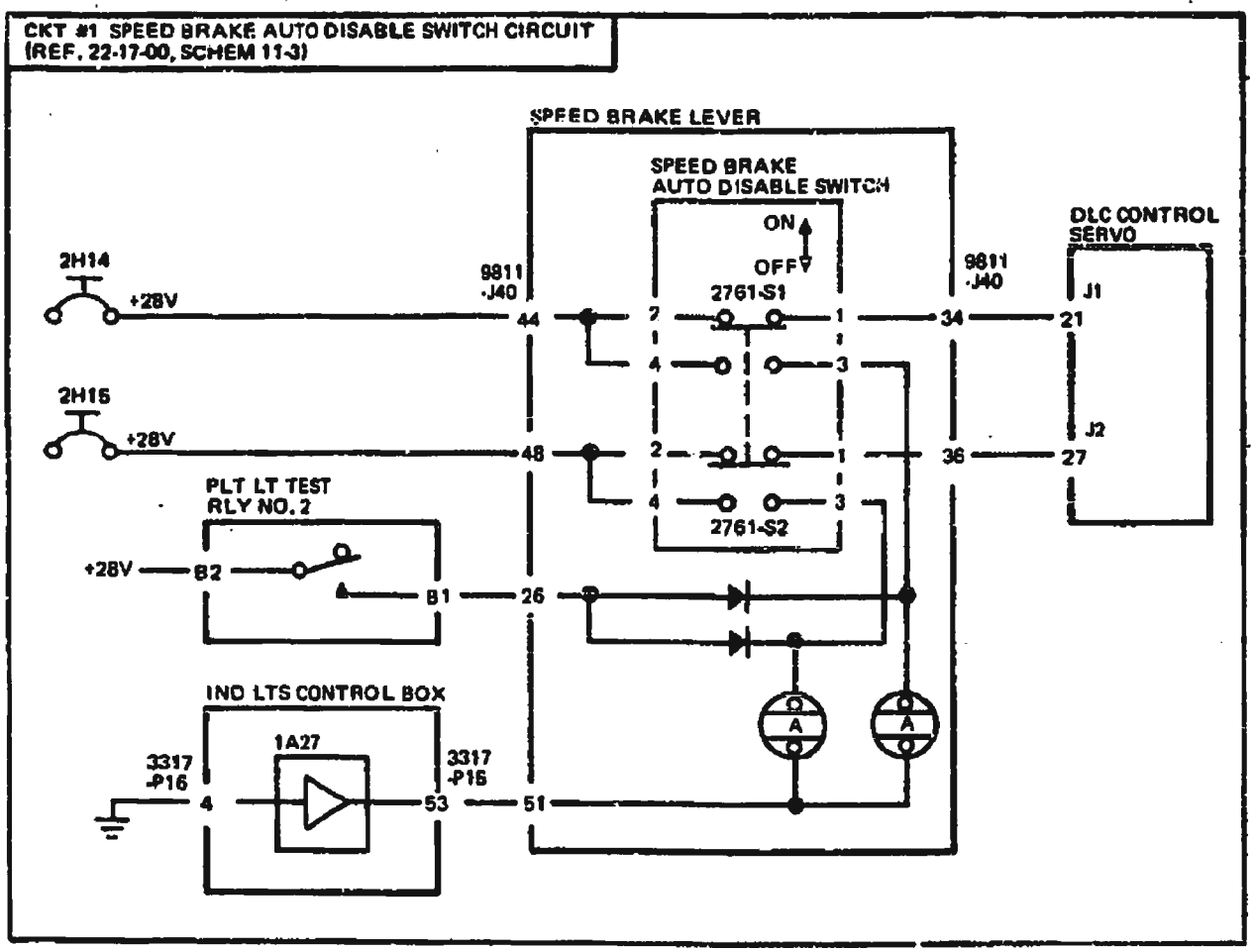

5
DLC FAILED TO OPERATE, BOTH DLC/AUTO SPLR FAIL LIGHTS AND AUTO GND SPLRS INOP ANNUNCIATOR ON
On FCES cmptr
O Chk COMPUTER FAULT FIM
O Chk DLC SWITCHES FIM
O Chk DLC SERVO 1 and 2 FIM
COMPUTER FAULT FIM or no FIM
Replace FCES cmptr (22-17-01)
DLC SWITCHES FIM
Go to Fault 12, then Fault 13 as required (Fig. 105 AGS Faults)
DLC SERVO FIM
Chk system friction per DLC SERVO manual mode oper. test (27-61-00)
Friction high
Locate and repair source of binding
Friction normal
Replace DLC servo (27-61-06)

MI-0004-22-1271

R DLC Faults
R Figure 104 (Sheet 12)

6	SPEED BRAKE AUTOMATIC DISABLE LIGHT(S) ON SPEED BRAKE HANDLE REMAIN ON, CYCLED SWITCH TO NO EFFECT. DLC (DID, DID NOT) OPERATE





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DLC Faults
Figure 104 (Sheet 13)

7 DLC FAILED TO OPERATE, BOTH DLC/AUTO SPLR FAIL AND BOTH STALL WARN FAIL LIGHTS ON

→ Replace FCES cmptr (22-17-01)

8 DLC FAILED TO OPERATE, CYCLED DLC/AUTO SPLR SWITCHES OFF AND ON BUT COULD NOT RESET, BOTH STALL WARN FAIL LIGHTS WERE ALSO ON

→ Replace FCES cmptr (22-17-01)

M1-0100-22-1310

DLC Faults
Figure 104 (Sheet 14)

10 NO AGS AFTER LANDING, ALL FAIL LIGHTS OUT

Replace FCES cmptr (22-17-01)

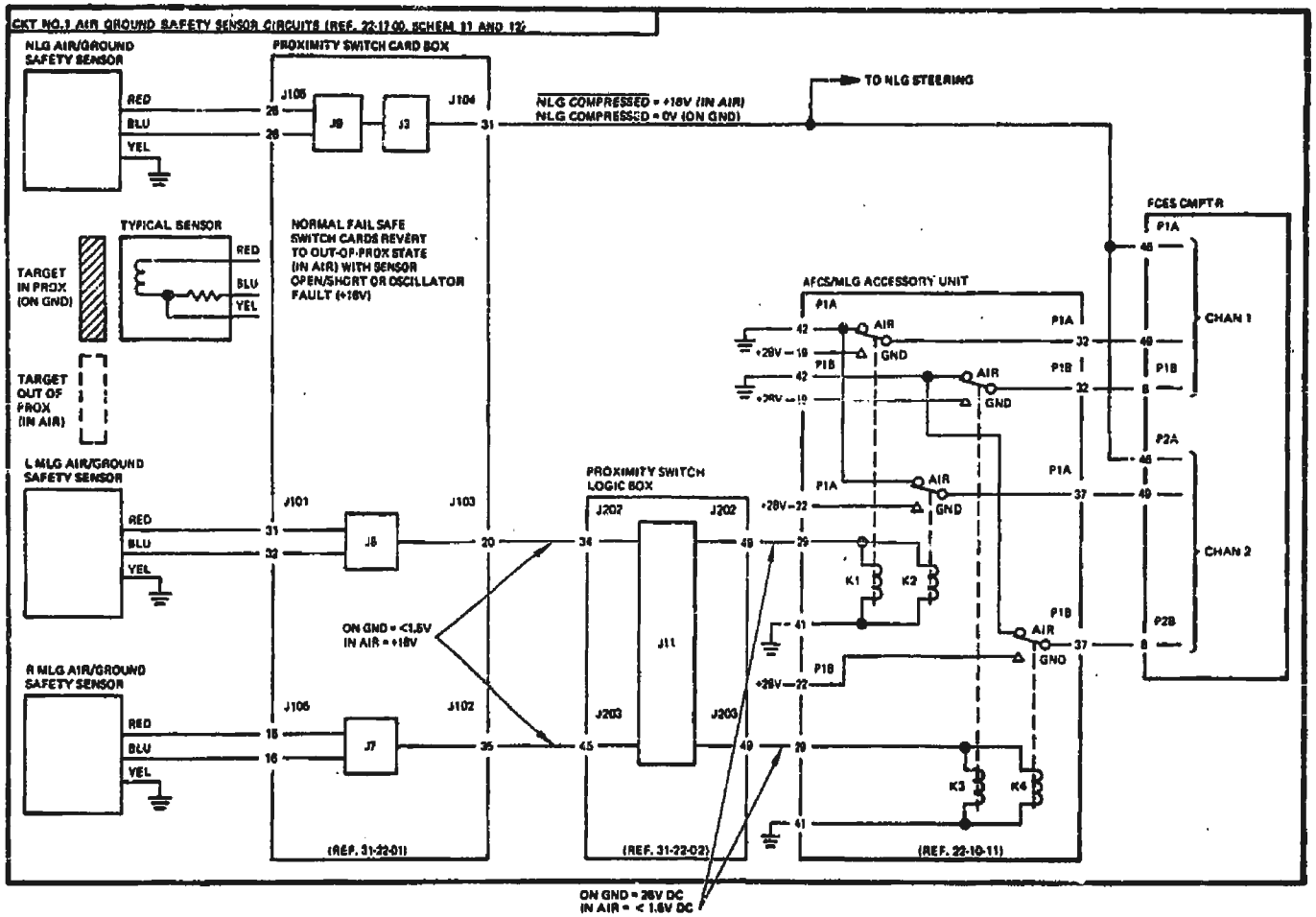
11 BOTH DLC/AUTO SPLR FAIL LIGHTS CAME ON AFTER TOUCHDOWN, BOTH MAIN GEARS TOUCHED TOGETHER, AGS INOP LIGHT ON.

Was there a "Rudder Pedal Steering" fault writeup in aircraft log?

- Yes → Test proximity switch card box modules J3 and J9
  - Test bad → Replace faulty module (31-22-01)
  - Test good → Visually check NLG air/gnd safety sensor for in prox target gap condition (32-63-02)
    - Gap bad → Replace/adjust sensor (32-63-02)
    - Gap good → Chk NLG sensor wiring in ckt #1. Repair as required
- No → Chk ckt #1 to verify on gnd condition from sensors at FCES cmptr
  - Chk bad → A target/sensor gap problem is suspected. Visually inspect left and right MLG safety sensors for in prox target gap condition (32-63-01)
    - Gap bad → Replace/adjust sensor (32-63-01)
    - Gap good → Test proximity switch card box modules J3, J7, J8, J9
      - Test bad → Replace faulty module (31-22-01)
      - Test good → Test proximity switch logic box module J11
        - Test bad → Replace faulty module (31-22-02)
        - Test good → Chk ckt #1
          - Bad AFCS/MLG unit → Replace AFCS/MLG accessory unit (22-10-11)
          - Wiring fault → Repair wiring
  - Chk ok → Perform faults 12 and 13

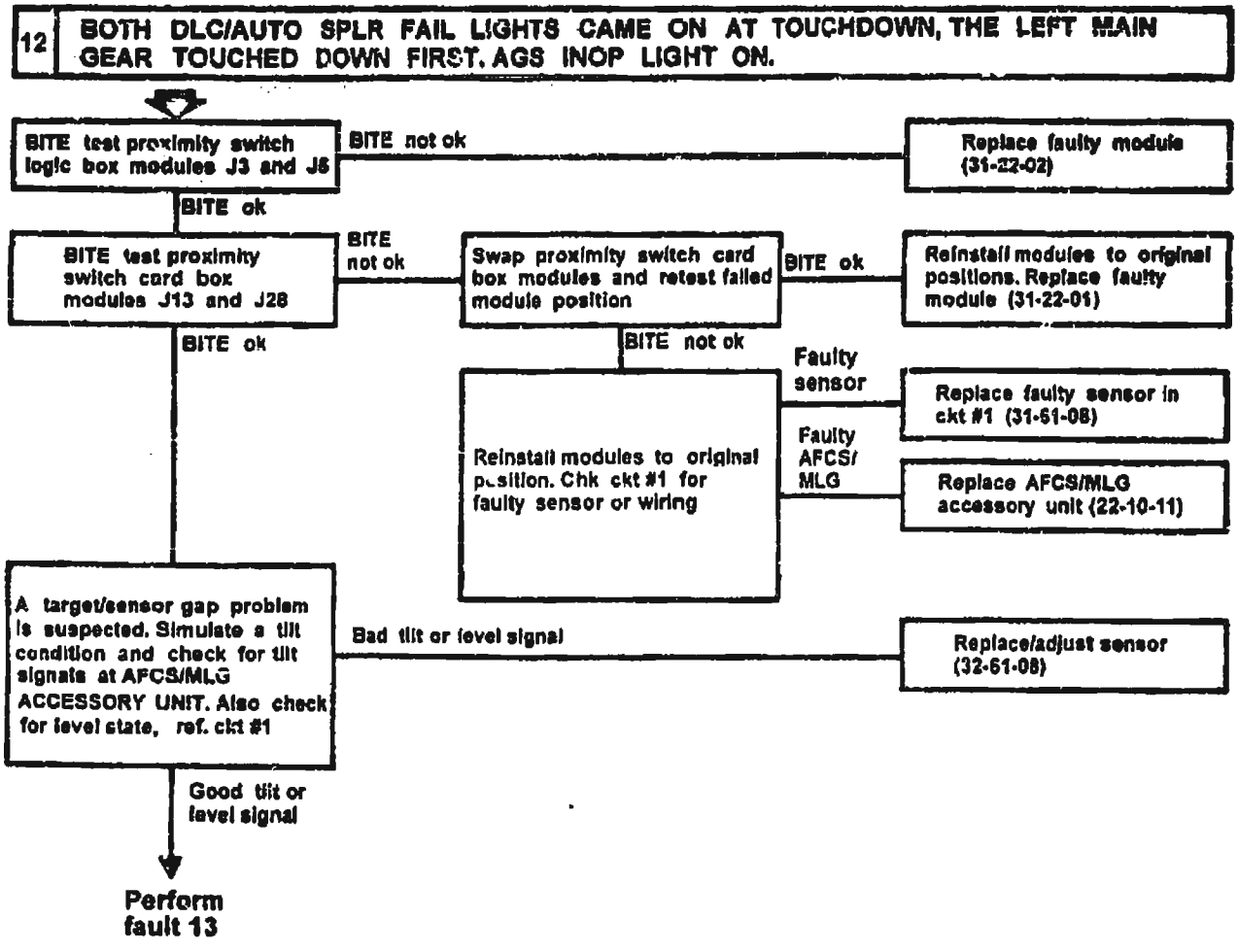
M1-0002-22-1276

AGS Faults
Figure 105 (Sheet 1)



M1-0004-22-1277

AGS Faults
Figure 105 (Sheet 2)


12
BOTH DLC/AUTO SPLR FAIL LIGHTS CAME ON AT TOUCHDOWN, THE LEFT MAIN GEAR TOUCHED DOWN FIRST. AGS INOP LIGHT ON.
BITE test proximity switch logic box modules J3 and J6
BITE not ok
Replace faulty module (31-22-02)
BITE ok
BITE test proximity switch card box modules J13 and J28
BITE not ok
Swap proximity switch card box modules and retest failed module position
BITE ok
Reinstall modules to original positions. Replace faulty module (31-22-01)
BITE ok
BITE not ok
Faulty sensor
Replace faulty sensor in ckt #1 (31-61-08)
Reinstall modules to original position. Chk ckt #1 for faulty sensor or wiring
Faulty AFCS/ MLG
Replace AFCS/MLG accessory unit (22-10-11)
A target/sensor gap problem is suspected. Simulate a tilt condition and check for tilt signals at AFCS/MLG ACCESSORY UNIT. Also check for level state, ref. ckt #1
Bad tilt or level signal
Replace/adjust sensor (32-61-08)
Good tilt or level signal
Perform fault 13

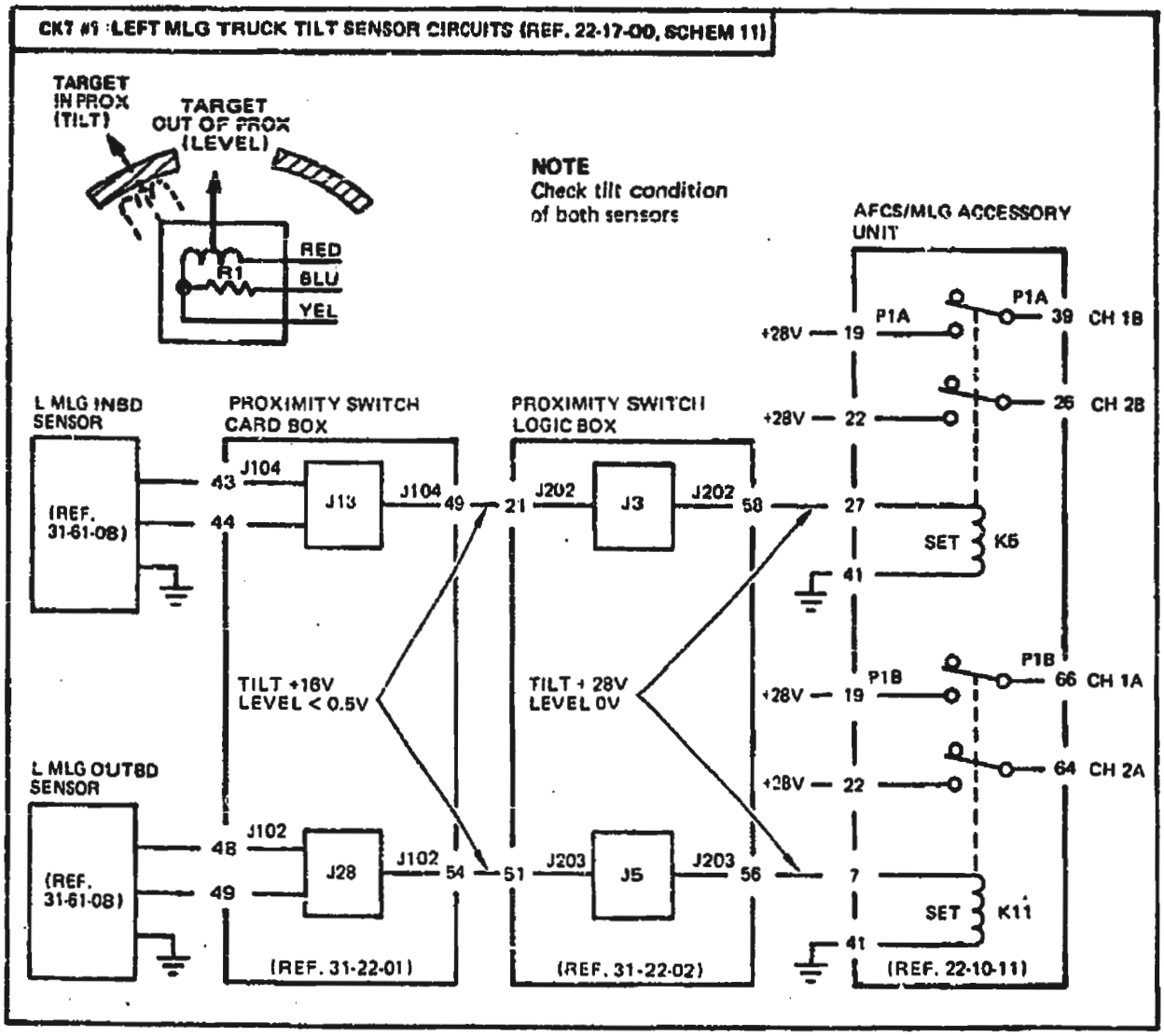
M1-0002-22-1278

R
R

AGS Faults
Figure 105 (Sheet 3)

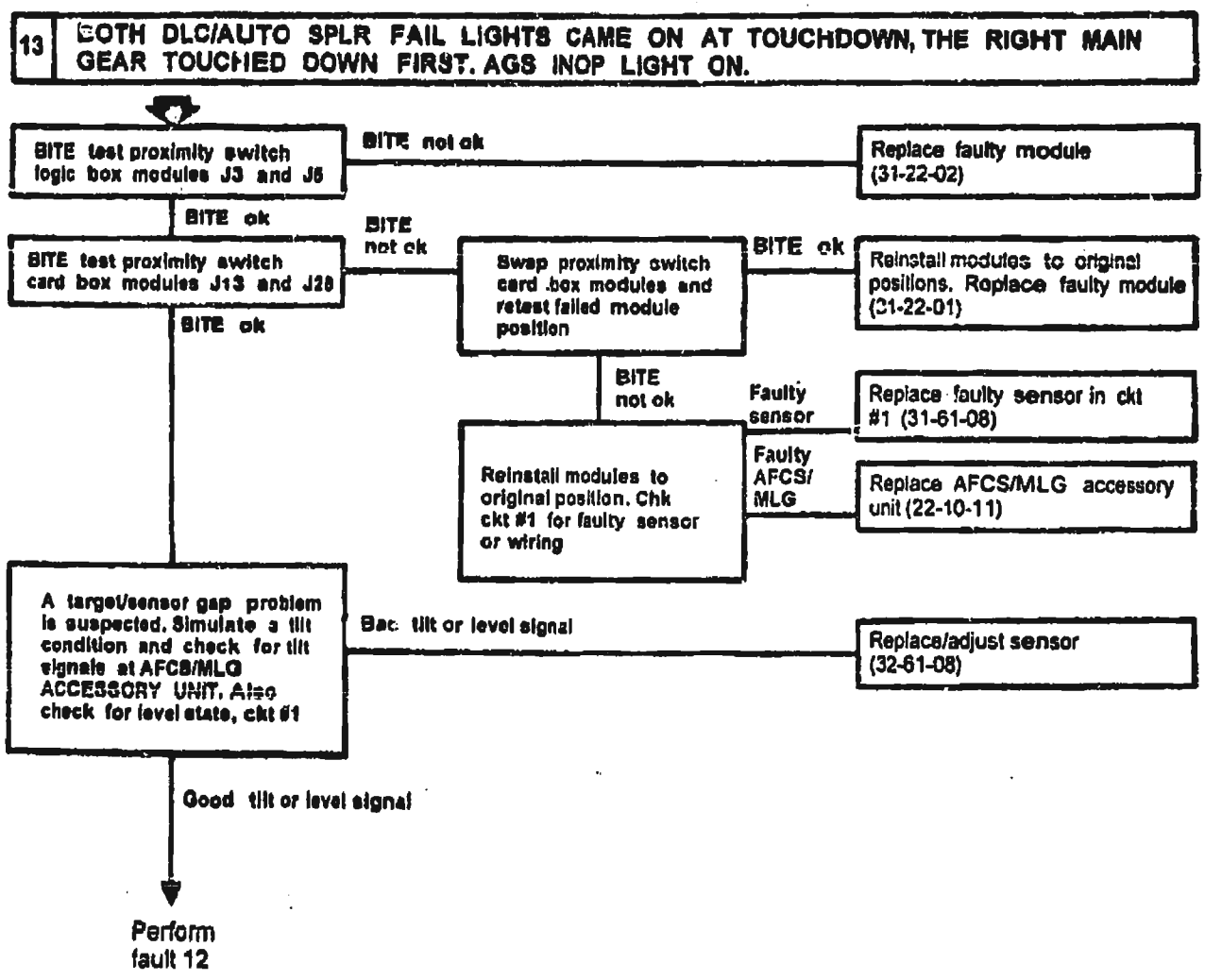
EFFECTIVITY: ALL

001B



M1-0002-22-1279

AGS Faults
Figure 105 (Sheet 4)


13
BOTH DLC/AUTO SPLR FAIL LIGHTS CAME ON AT TOUCHDOWN, THE RIGHT MAIN GEAR TOUCHED DOWN FIRST. AGS INOP LIGHT ON.
BITE test proximity switch logic box modules J3 and J6
BITE not ok
Replace faulty module (31-22-02)
BITE ok
BITE test proximity switch card box modules J13 and J28
BITE not ok
Swap proximity switch card box modules and retest failed module position
BITE ok
Reinstall modules to original positions. Replace faulty module (31-22-01)
BITE ok
BITE not ok
Faulty sensor
Replace faulty sensor in ckt #1 (31-61-08)
Reinstall modules to original position. Chk ckt #1 for faulty sensor or wiring
Faulty AFCS/ MLG
Replace AFCS/MLG accessory unit (22-10-11)
A target/sensor gap problem is suspected. Simulate a tilt condition and check for tilt signals at AFCS/MLG ACCESSORY UNIT. Also check for level state, ckt #1
Bad tilt or level signal
Replace/adjust sensor (32-61-08)
Good tilt or level signal
Perform fault 12

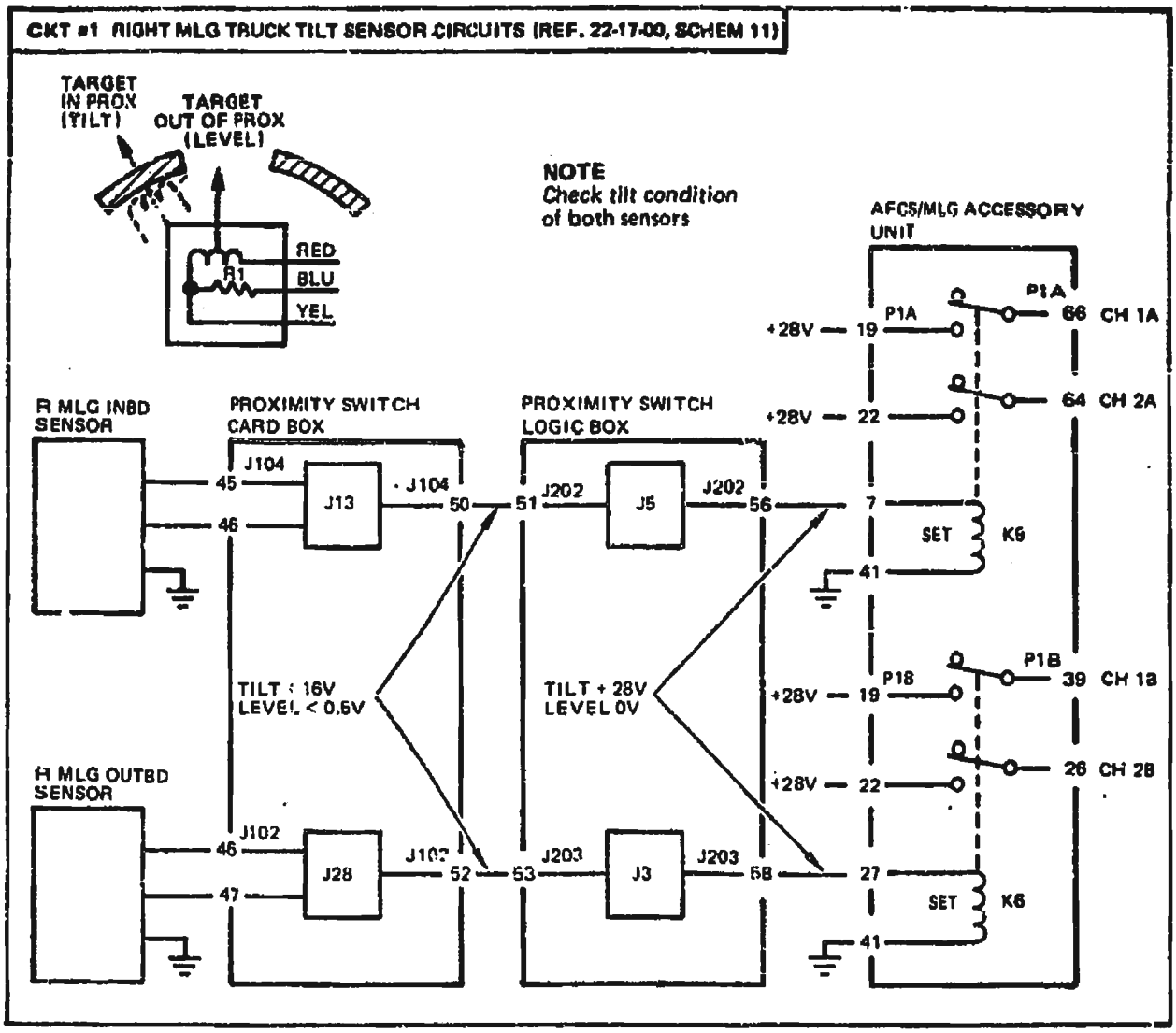
MI-0002-22-1280

R
R

AGS Faults
Figure 105 (Sheet 5)

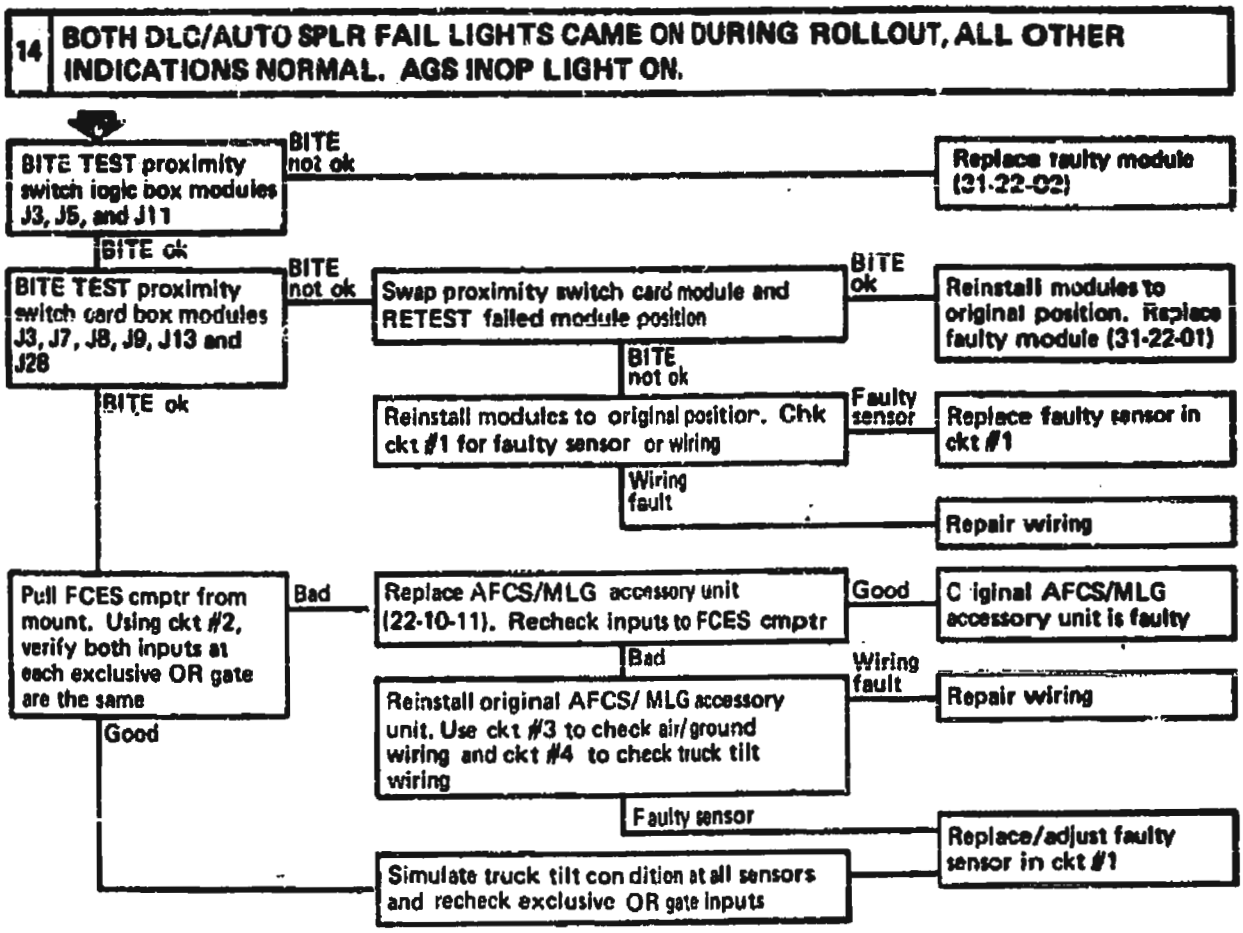
EFFECTIVITY: ALL

001B



M1-0002-22-1281

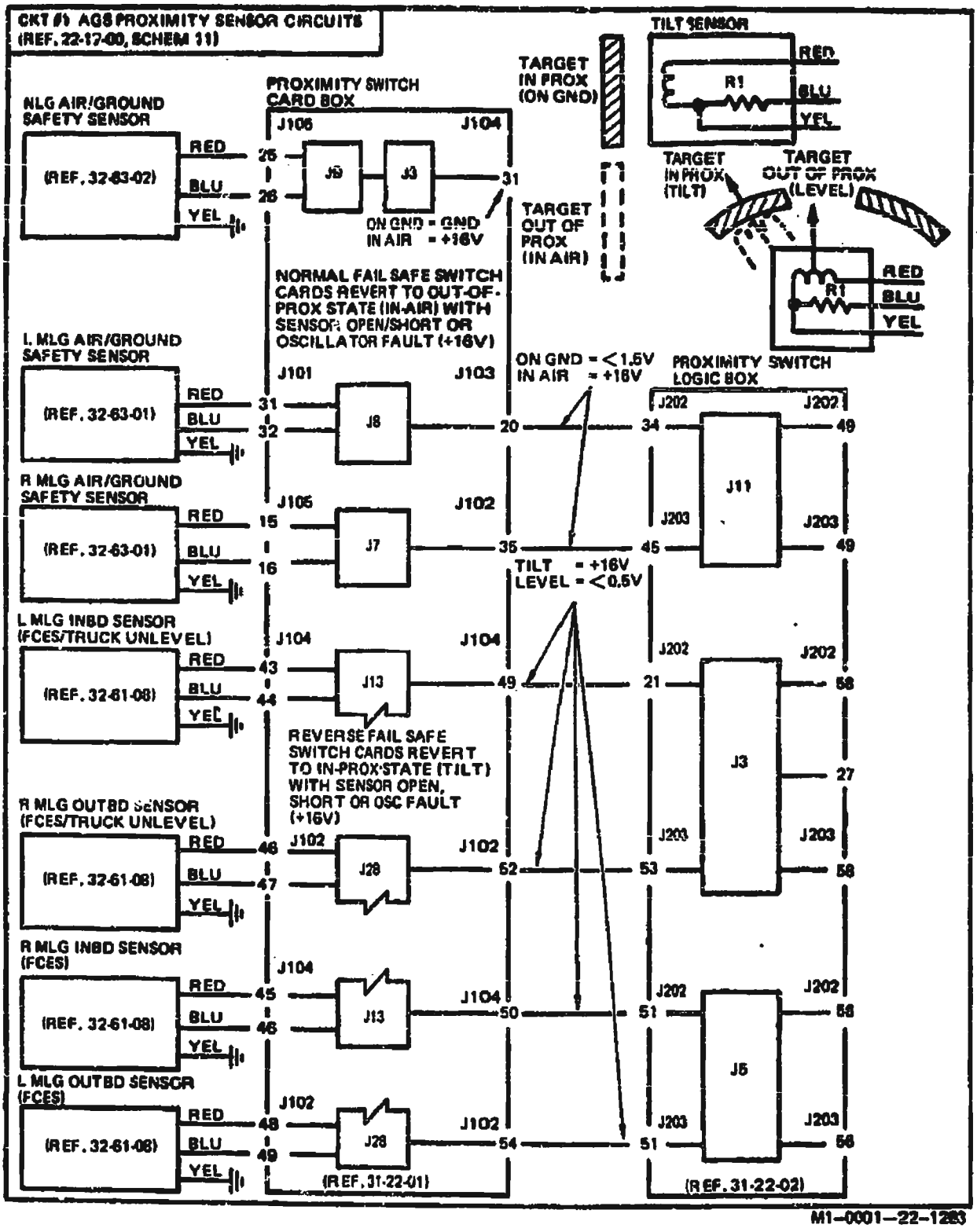
AGS Faults
Figure 105 (Sheet 6)


14 BOTH DLC/AUTO SPLR FAIL LIGHTS CAME ON DURING ROLLOUT, ALL OTHER INDICATIONS NORMAL. AGS INOP LIGHT ON.
BITE TEST proximity switch logic box modules J3, J5, and J11
BITE not ok
Replace faulty module (31-22-02)
BITE ok
BITE TEST proximity switch card box modules J3, J7, J8, J9, J13 and J28
BITE not ok
Swap proximity switch card module and RETEST failed module position
BITE ok
Reinstall modules to original position. Replace faulty module (31-22-01)
BITE not ok
Reinstall modules to original position. Chk ckt #1 for faulty sensor or wiring
Faulty sensor
Replace faulty sensor in ckt #1
Wiring fault
Repair wiring
BITE ok
Pull FCES cmptr from mount. Using ckt #2, verify both inputs at each exclusive OR gate are the same
Bad
Replace AFCS/MLG accessory unit (22-10-11). Recheck inputs to FCES cmptr
Good
Original AFCS/MLG accessory unit is faulty
Bad
Wiring fault
Reinstall original AFCS/ MLG accessory unit. Use ckt #3 to check air/ground wiring and ckt #4 to check truck tilt wiring
Repair wiring
Good
Faulty sensor
Replace/adjust faulty sensor in ckt #1
Simulate truck tilt condition at all sensors and recheck exclusive OR gate inputs

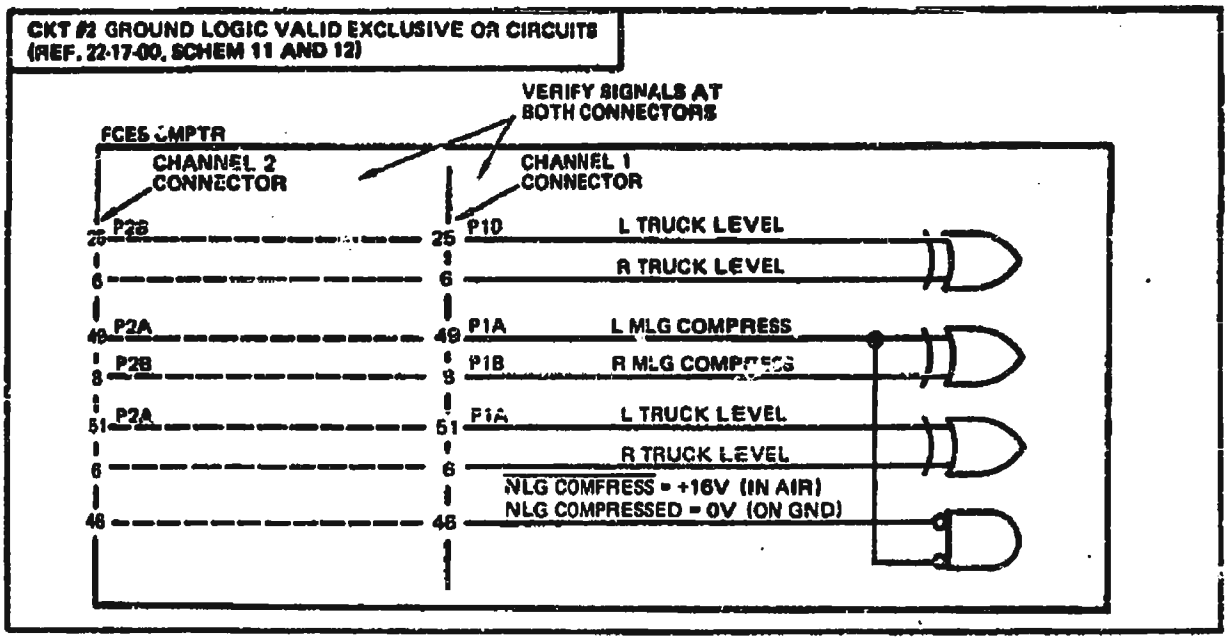
M1-0002-22-1282

AGS Faults
Figure 105 (Sheet 7)

R EFFECTIVITY: ALL
R
001B

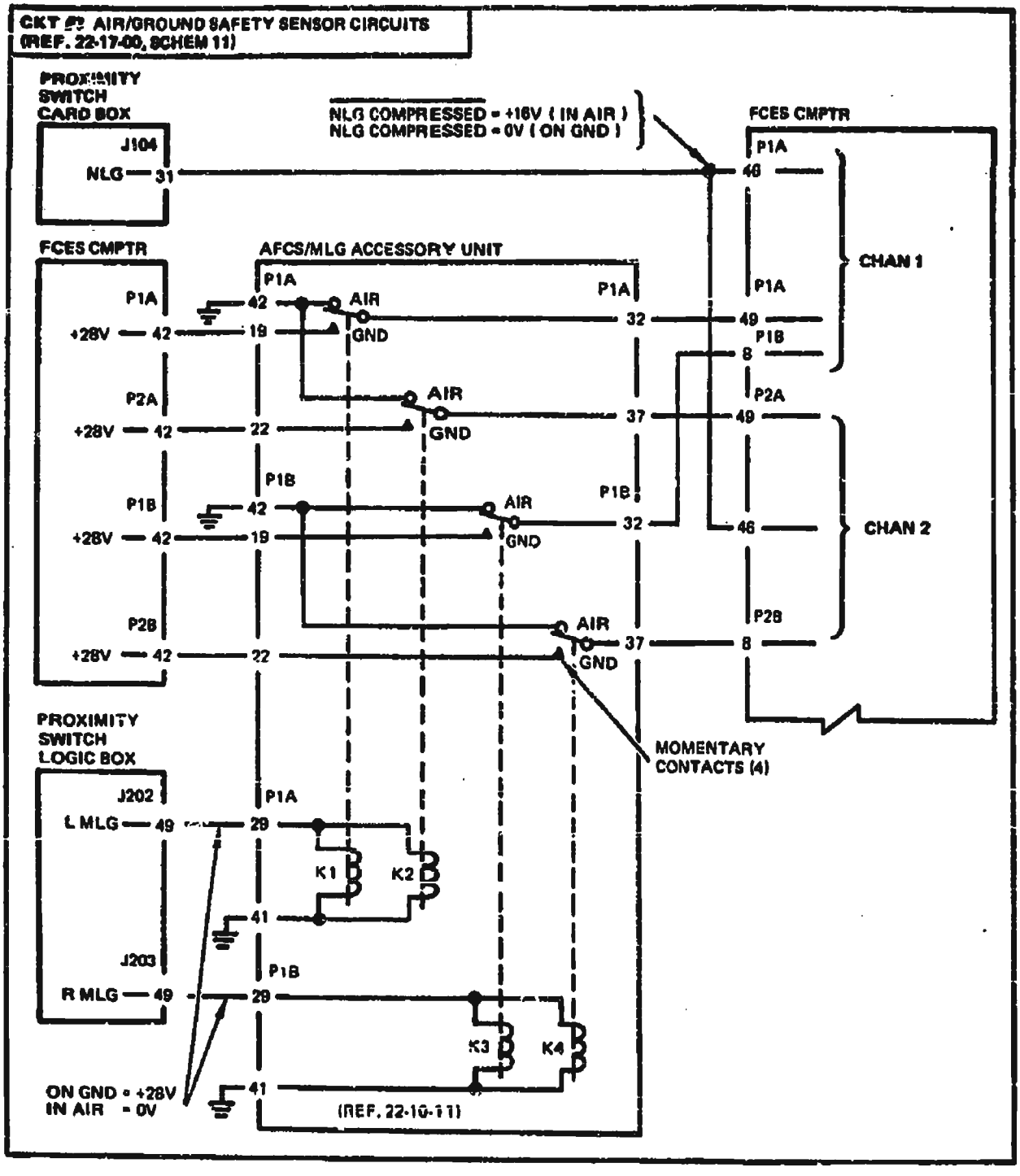


AGS Faults
Figure 105 (Sheet 8)



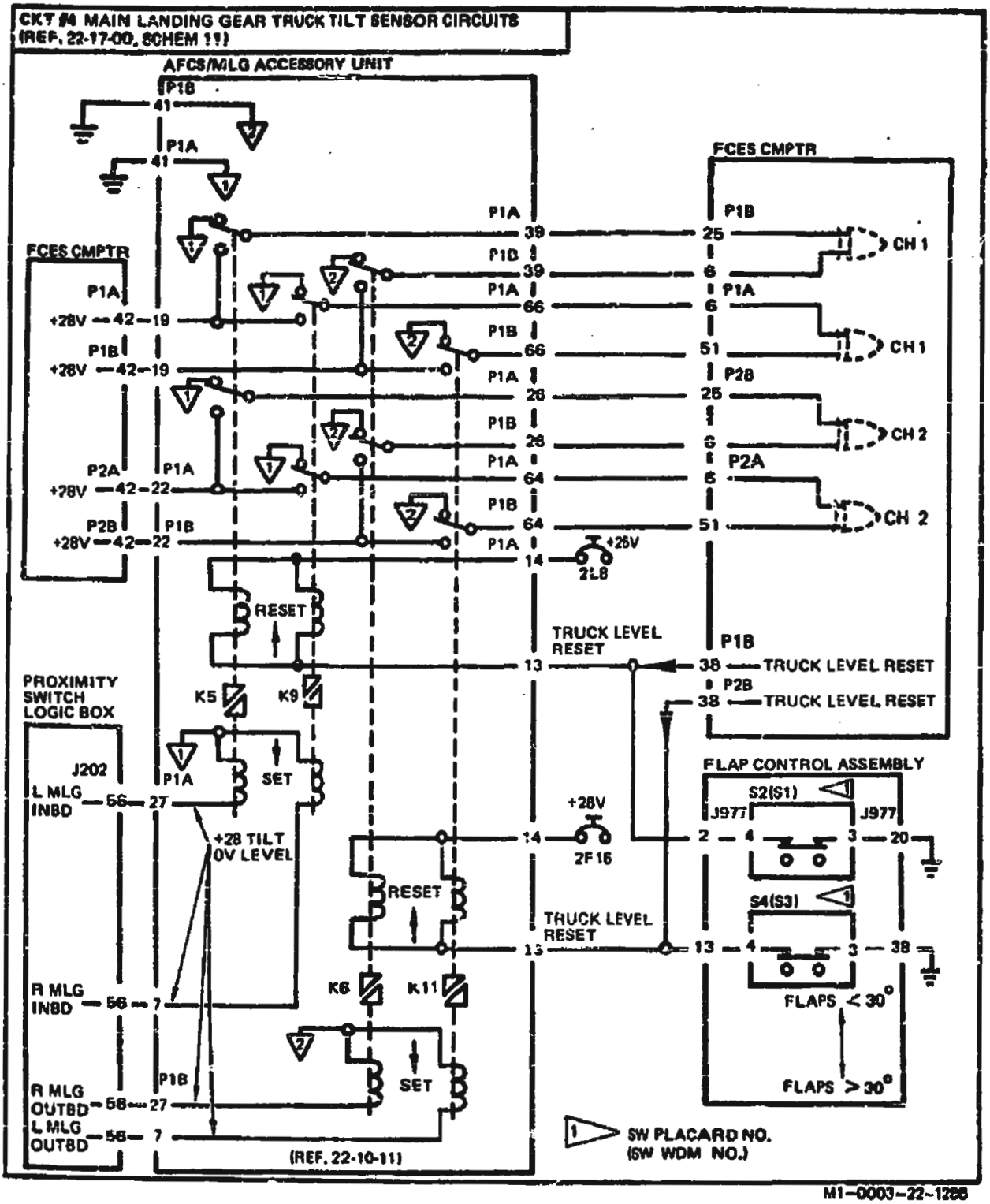
M1-0003-22-1284

AGS Faults
Figure 105 (Sheet 9)



M1-0003-22-1286

AGS Faults
Figure 105 (Sheet 10)



AGS Faults
Figure 105 (Sheet 11)

15 AUTO GND SPLRS INOP ANNUNCIATOR CAME ON DURING APPROACH, DLC OPERATION NORMAL. BOTH DLC/AUTO SPLR FAIL LIGHTS CAME ON AT TOUCHDOWN

Verify hydro sys "C" is on. Chk ckt #1 for HYDRO C PRESS signals to FCES cmptr

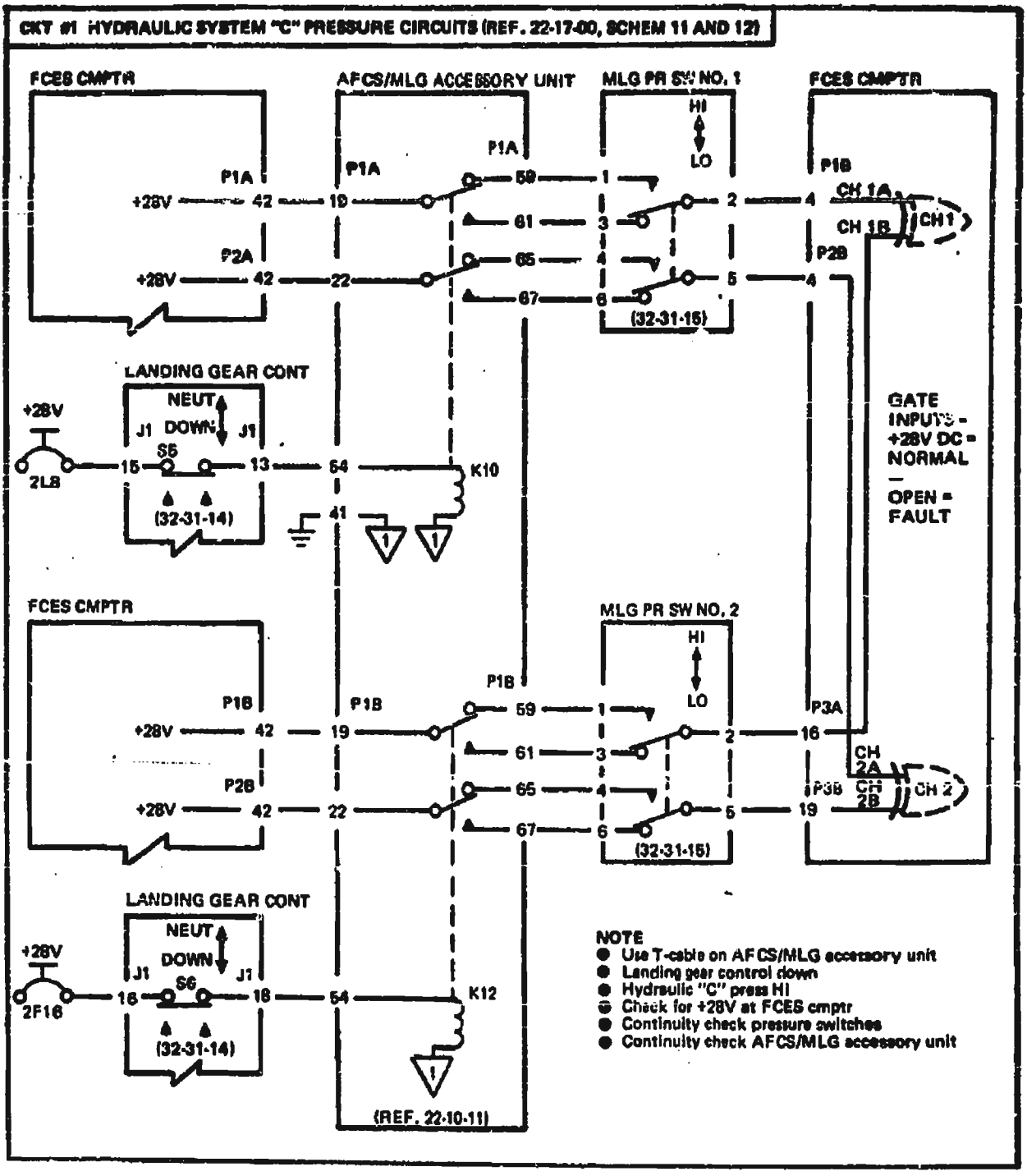
- MLG press sw No. 1 or 2 bad → Replace Hydro "C" pressure switch (32-31-15)
- AFCS/MLG accessory unit bad → Replace AFCS/MLG accessory unit (22-10-11)
- Landing gear control bad → Replace landing gear control switch (32-31-14)
- Wiring fault → Repair wiring
- Ckt #1 chk ok → Replace FCES cmptr (22-17-01). If problem persists, troubleshoot Oleo and Tilt circuits (32-11-00, 32-61-00)

NOTE

1 Oleo and Tilt sensor faults during approach can be remote, but any sensor fault can cause AGS INOP

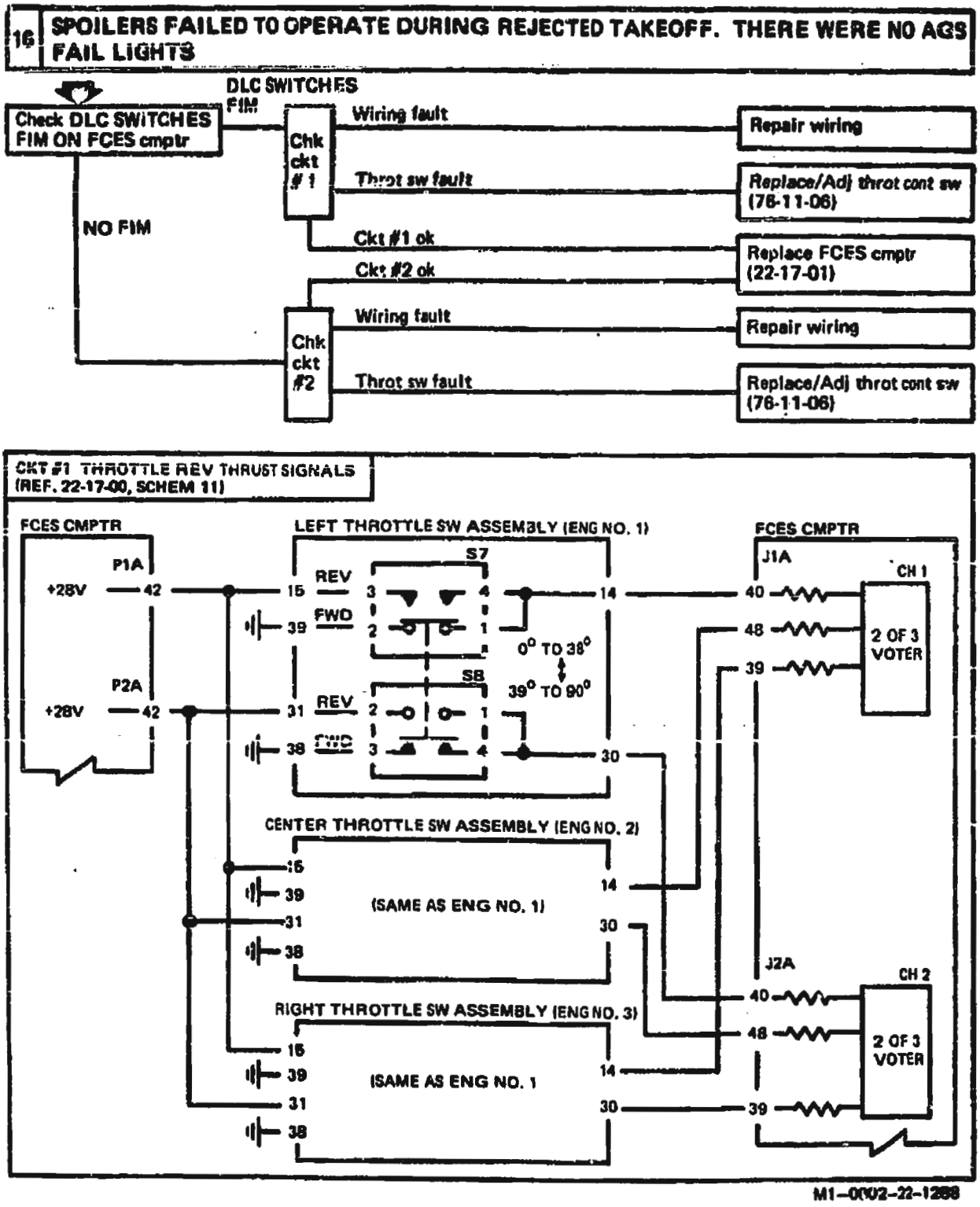
M1-0003-22-1287

AGS Faults
Figure 105 (Sheet 12)

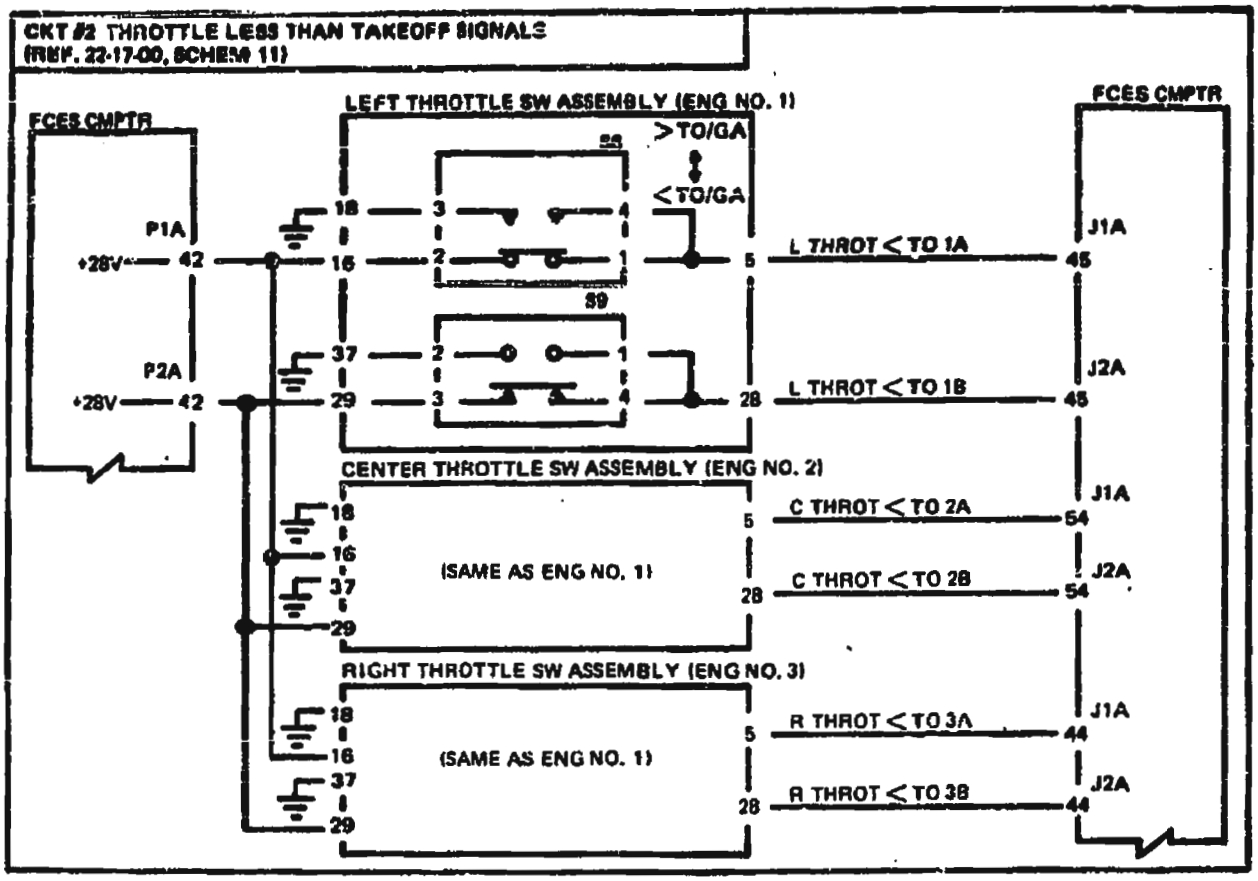


M1—0003—22—1261

AGS Faults
Figure 105 (Sheet 13)



AGS Faults
Figure 105 (Sheet 14)



M1-0001-22-1

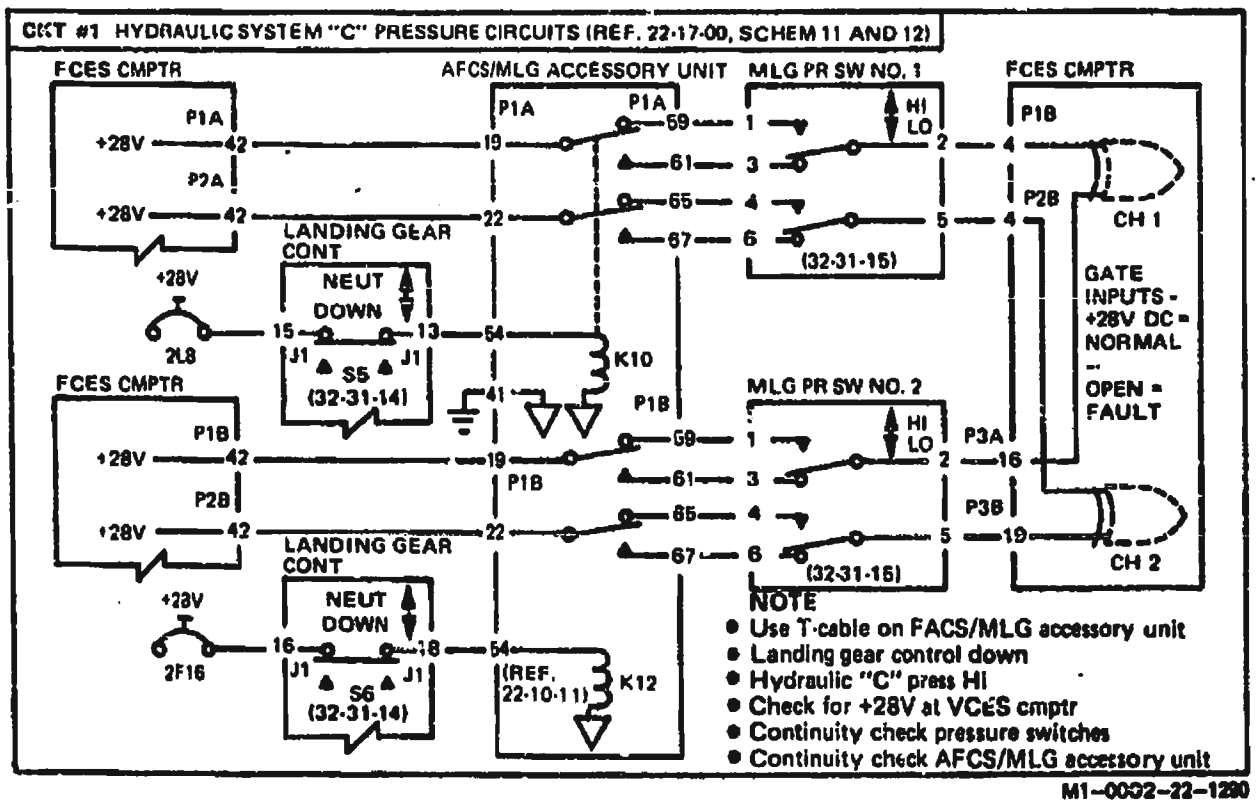
AGS Faults
Figure 105 (Sheet 15)

R
R
0018 EFFECTIVITY: ALL

17	SPOILERS FAILED TO OPERATE DURING REJECTED TAKEOFF, AUTO GND SPLRS INOP ANNUNCIATOR CAME ON. NO AGS FAIL LIGHTS

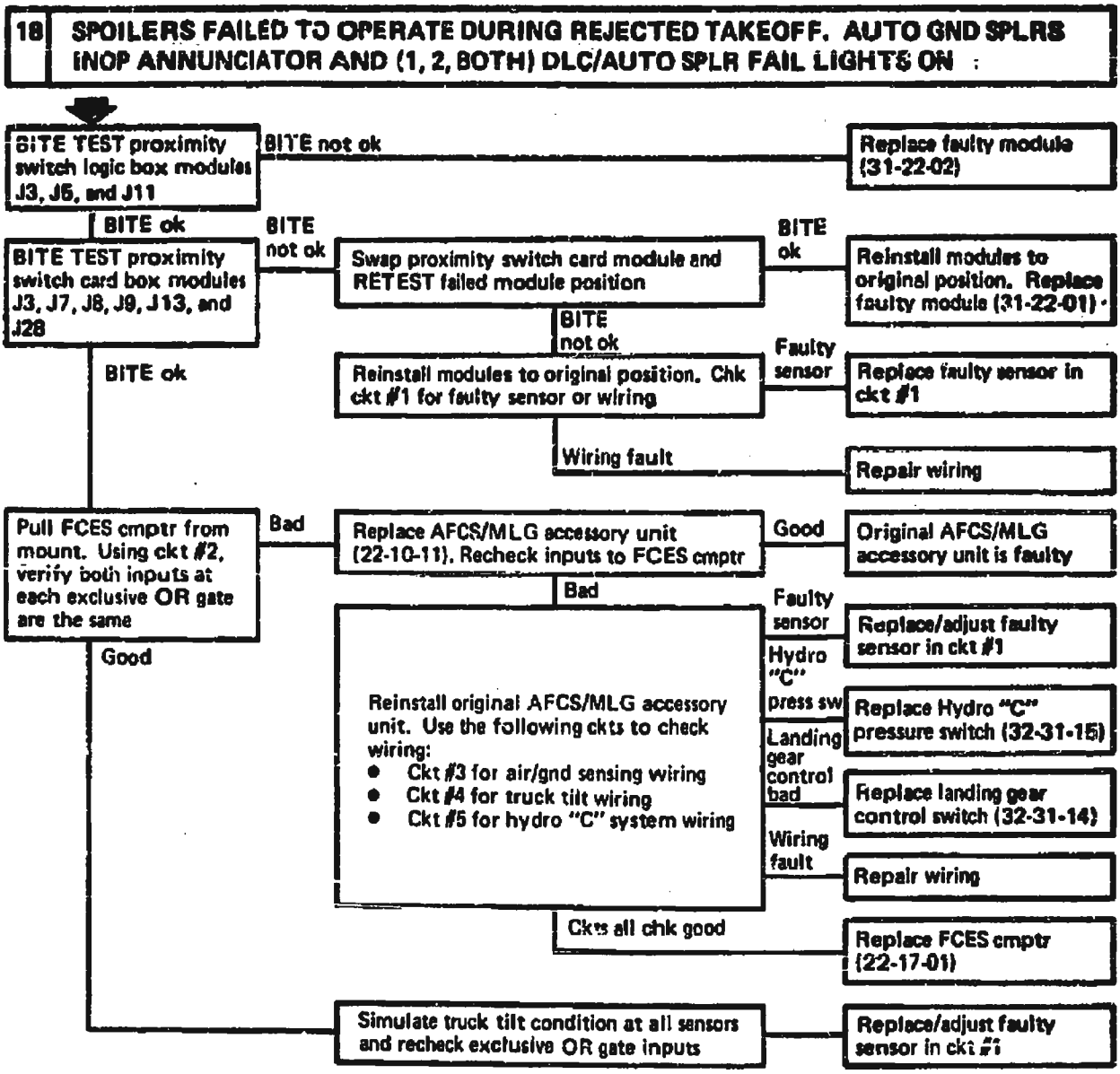
Verify hydro-sys "C" is on. Chk ckt #1 for HYDRO C PRESS signals to FCES cmptr

- MLG press sw No. 1 or 2 bad → Replace Hydro "C" pressure switch (32-31-15)
- AFCS/MLG accessory unit bad → Replace AFCS/MLG accessory unit (22-10-11)
- Landing gear control bad → Replace landing gear control switch (32-31-14)
- Wiring fault → Repair wiring
- Ckt #1 chk ok → Replace FCES cmptr (22-17-01). If problem persists, troubleshoot L or R oleo circuit Fig. 105, Sheet 10



M1-0002-22-1290

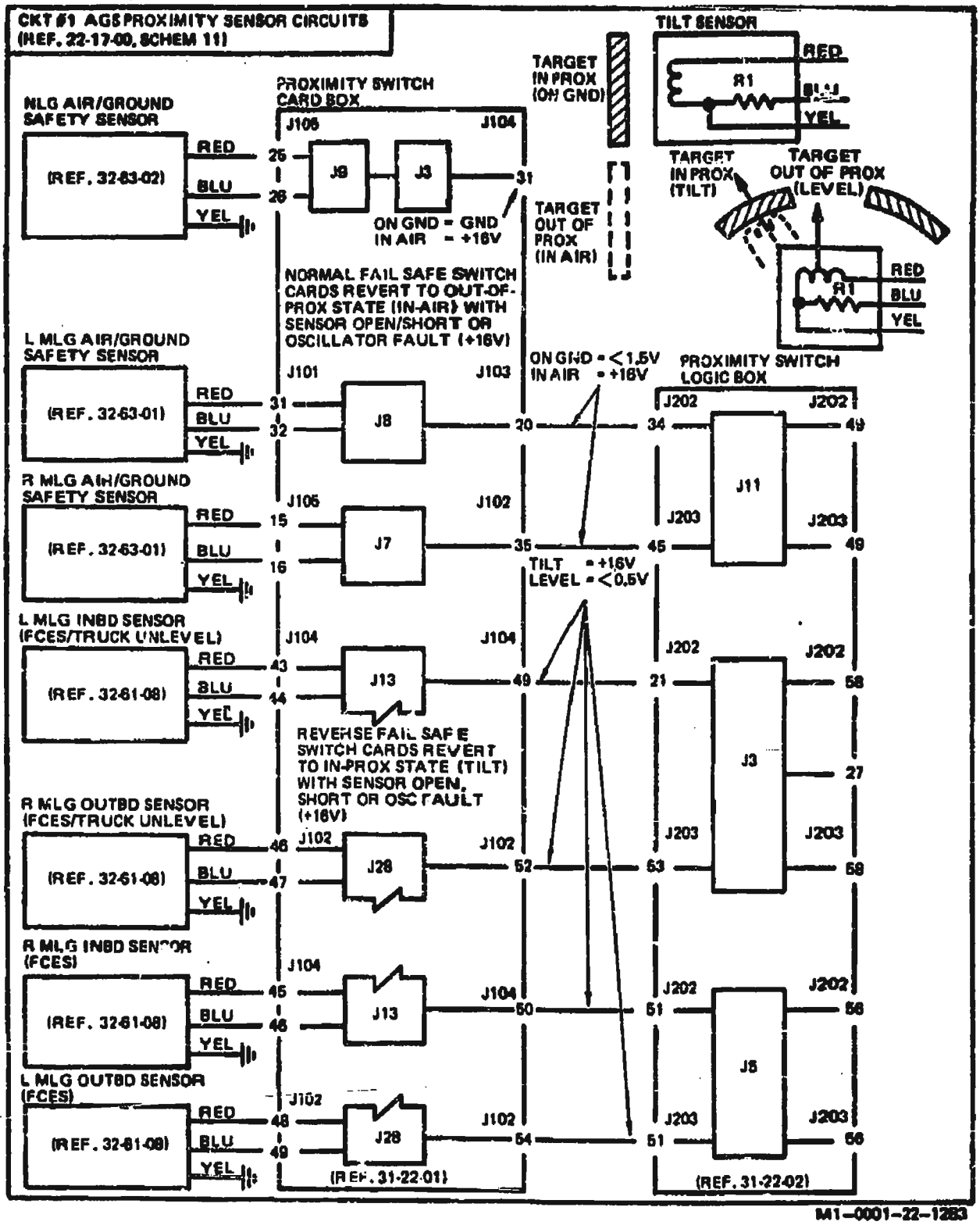
AGS Faults
Figure 105 (Sheet 16)


18 SPOILERS FAILED TO OPERATE DURING REJECTED TAKEOFF. AUTO GND SPLRS INOP ANNUNCIATOR AND (1, 2, BOTH) DLC/AUTO SPLR FAIL LIGHTS ON
BITE TEST proximity switch logic box modules J3, J5, and J11
BITE not ok
Replace faulty module (31-22-02)
BITE ok
BITE not ok
BITE TEST proximity switch card box modules J3, J7, J8, J9, J13, and J28
Swap proximity switch card module and RETEST failed module position
BITE ok
Reinstall modules to original position. Replace faulty module (31-22-01)
BITE not ok
Faulty sensor
Reinstall modules to original position. Chk ckt #1 for faulty sensor or wiring
Replace faulty sensor in ckt #1
Wiring fault
Repair wiring
BITE ok
Pull FCES cmptr from mount. Using ckt #2, verify both inputs at each exclusive OR gate are the same
Bad
Replace AFCS/MLG accessory unit (22-10-11). Recheck inputs to FCES cmptr
Good
Original AFCS/MLG accessory unit is faulty
Bad
Faulty sensor
Replace/adjust faulty sensor in ckt #1
Hydro "C" press sw
Replace Hydro "C" pressure switch (32-31-15)
Landing gear control bad
Replace landing gear control switch (32-31-14)
Wiring fault
Repair wiring
Reinstall original AFCS/MLG accessory unit. Use the following ckts to check wiring:
• Ckt #3 for air/gnd sensing wiring
• Ckt #4 for truck tilt wiring
• Ckt #5 for hydro "C" system wiring
Ckts all chk good
Replace FCES cmptr (22-17-01)
Good
Simulate truck tilt condition at all sensors and recheck exclusive OR gate inputs
Replace/adjust faulty sensor in ckt #1

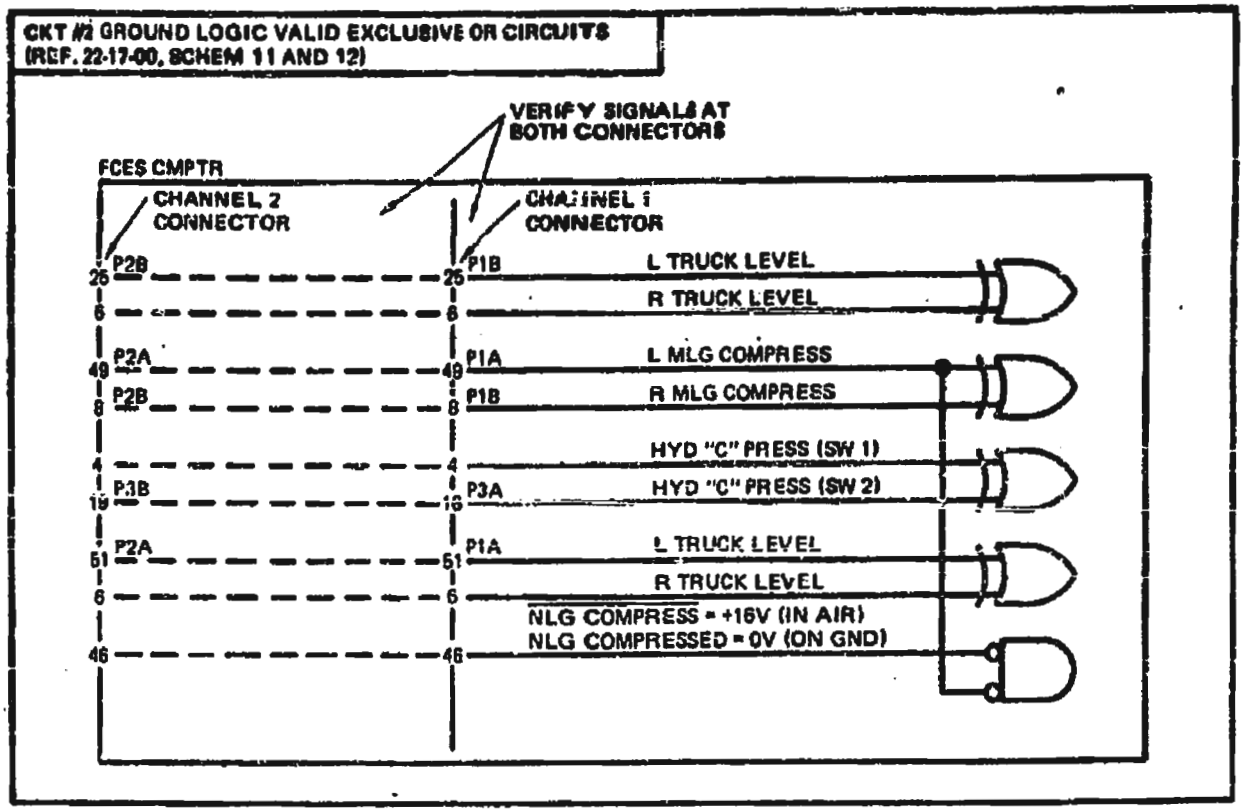
M1-0100-22-1291

AGS Faults
Figure 105 (Sheet 17)

R
R
001B EFFECTIVITY: ALL

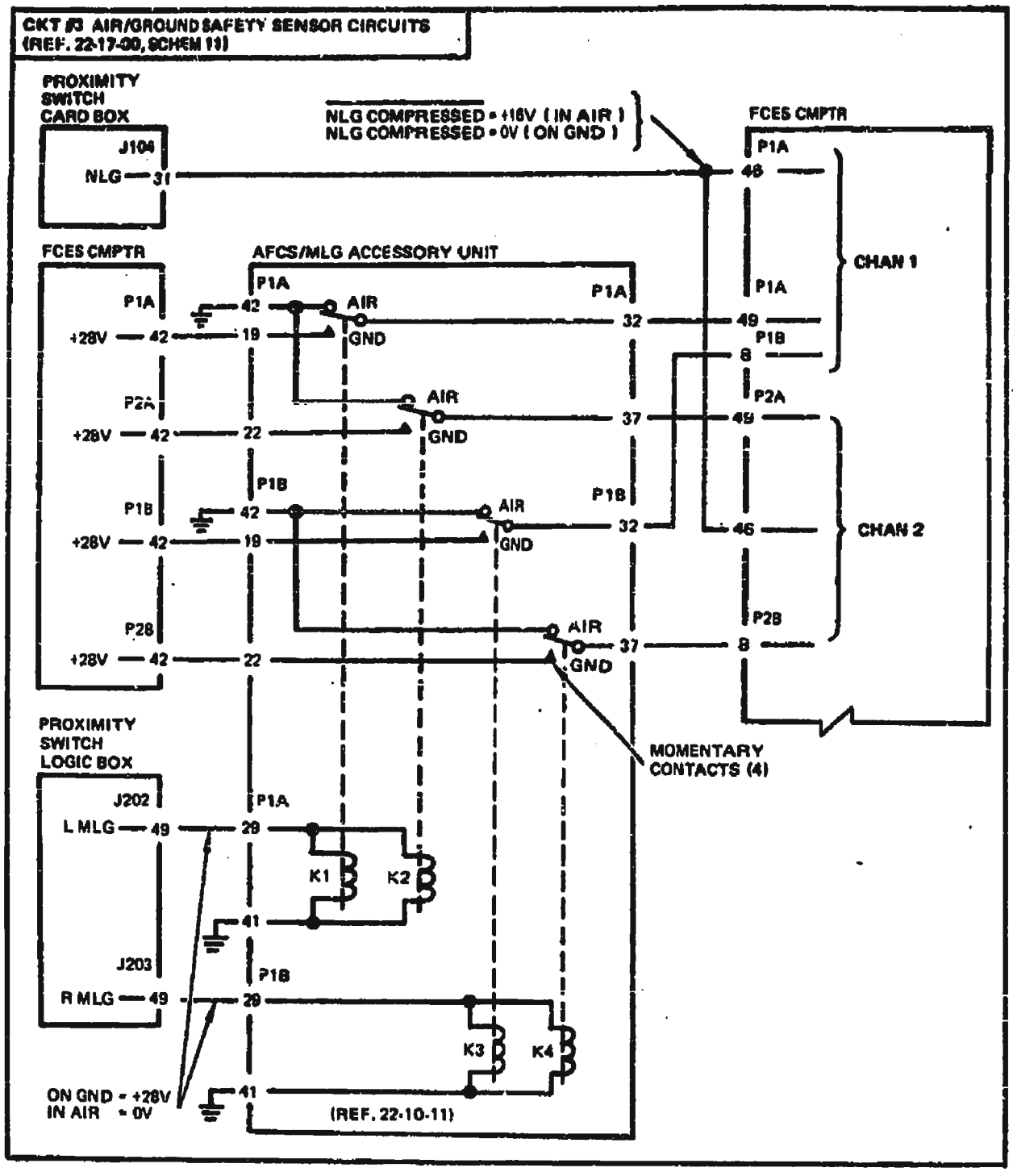


AGS Faults
Figure 105 (Sheet 18)



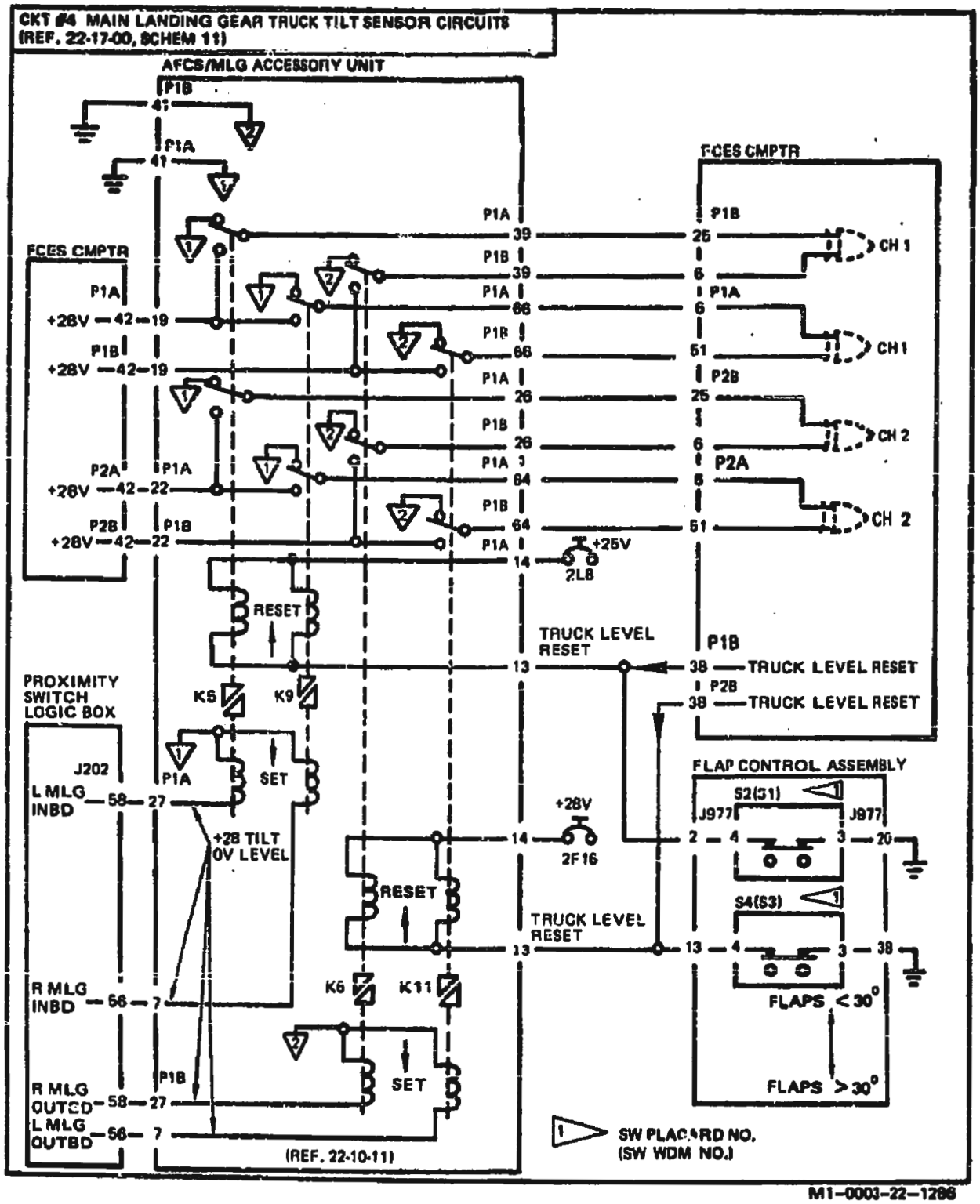
M1-0004-22-1292

AGS Faults
Figure 105 (Sheet 19)

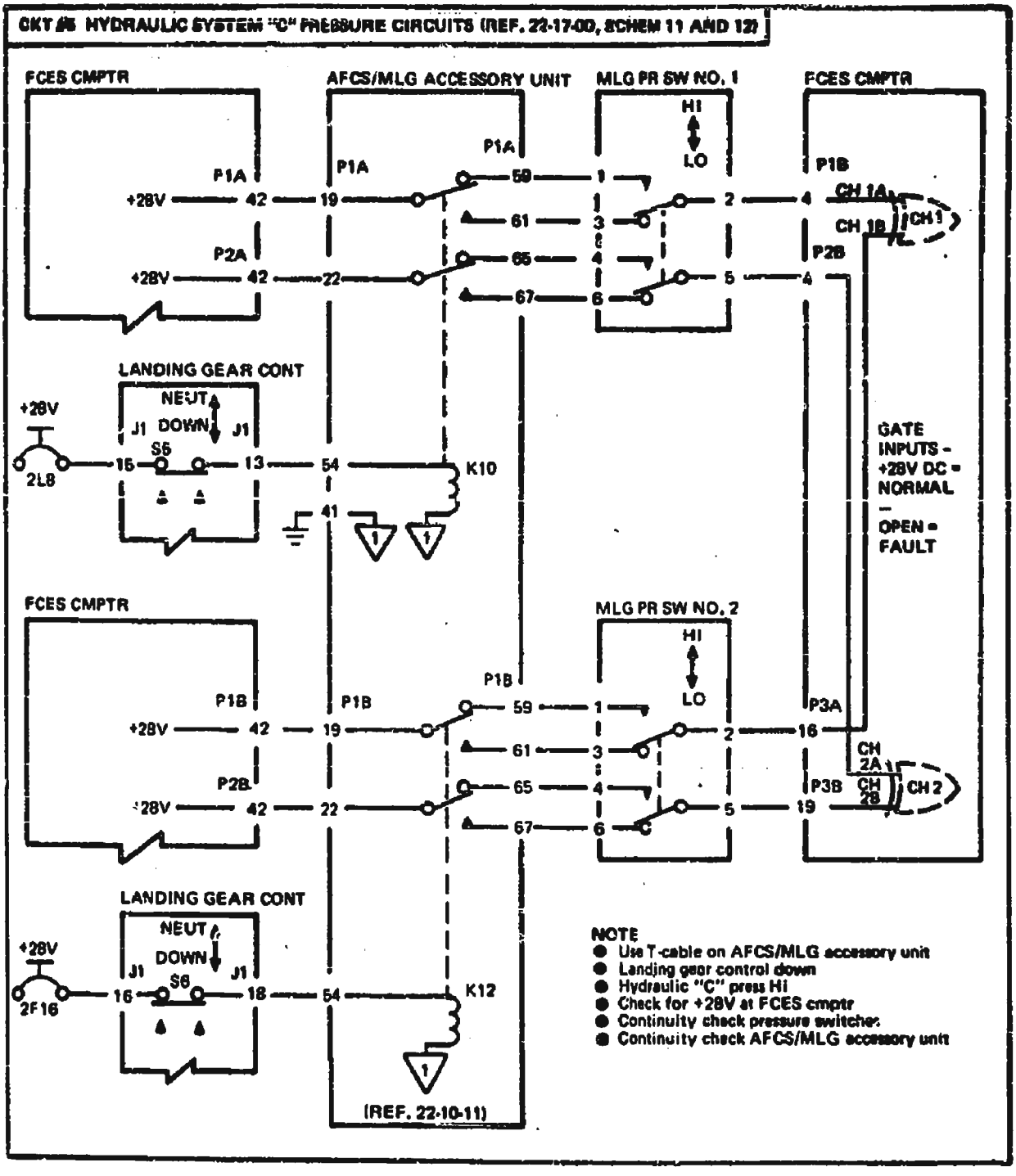


M1-0003-22-1286

AGS Faults
Figure 105 (Sheet 20)

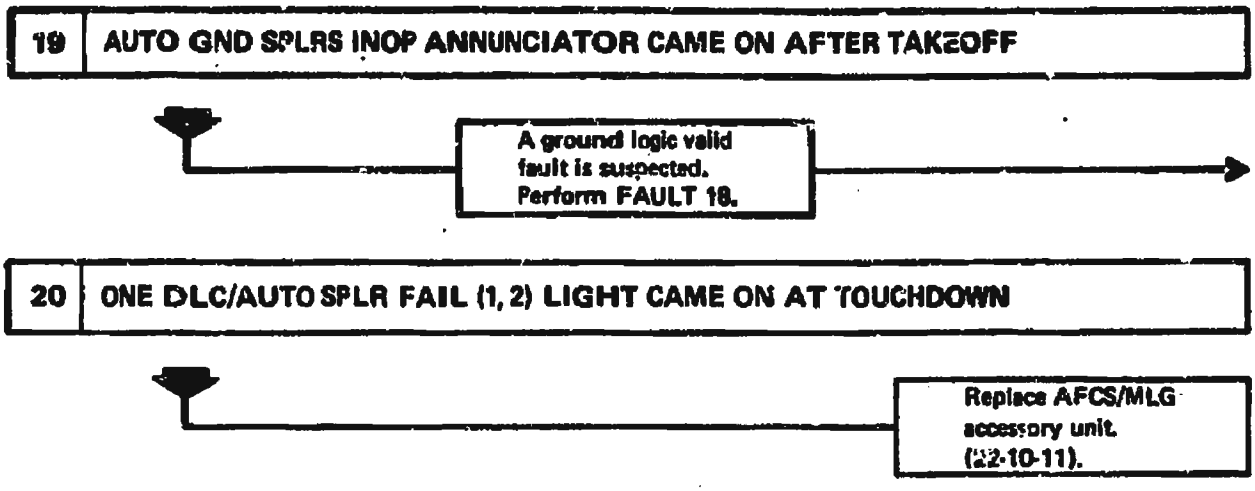


AGS Faults
Figure 105 (Sheet 21)



M1-0002-22-1293

AGS Faults
Figure 105 (Sheet 22)


19
AUTO GND SPLRS INOP ANNUNCIATOR CAME ON AFTER TAKEOFF
A ground logic valid fault is suspected. Perform FAULT 18.
20
ONE DLC/AUTO SPLR FAIL (1, 2) LIGHT CAME ON AT TOUCHDOWN
Replace AFCS/MLG accessory unit. (22-10-11).

M1-0101-22-1294

AGS Faults
Figure 105 (Sheet 23)

DIRECT LIFT CONTROL/AUTOMATIC GROUND SPOILER - ADJUSTMENT AND TEST

1. Referenced Procedures

21-00-00 Electronic and Electrical Service Centers Exhaust - Adjustment and Test

24-00-00 Electrical Power - Maintenance Practices

29-11-00 Hydraulic Power - Maintenance Practices

2. Direct Lift Control/Automatic Ground Spoiler (DLC/AGS) Test

The DLC/AGS test procedure (Ref. Table 501) consists of a test procedure, normal observation, faults and corrective actions. The test procedure and normal observations are used to verify the operational status of the system. When a fault occurs during the test, perform corrective actions adjacent to fault indication.

A. Preliminary Procedure.

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

TRIM AGMT AC (A7)

TRIM AGMT DC (A8)

TRIM AGMT AC (A25)

TRIM AGMT DC (A26)

FCES COMPUTERS AC & L AOA (B5)

NO. 1 AFT COUPLER (B9)

NO. 2 AFT COUPLER (B27)

INSTR XFMR NO. 3 (D27)

SURF POSN IND (J23)

ANN RESET (L9)

R PROX SW PWR NO. 1 (L10)

R PROX SW PWR NO. 4 (L11)

R (4) On flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, verify that the following
R circuit breakers are closed:

R R AOA (F1)

R TRUCK LEVEL (F16)

R GEAR CONT NO. 1 (F17)

R GEAR CONT NO. 2 (F18)

R NOSE STEERING (F19)

R F/E IND LT TEST 1 (H1)

R F/E IND LT TEST 2 (H2)

R F/E IND LT TEST 3 (H3)

R F/E IND LT TEST 4 (H4)

R F/E IND LT TEST 5 (H5)

R PILOTS IND LT TEST 1 (H8)

R PILOTS IND LT TEST 2 (H9)

R PILOTS IND LT TEST 3 (H10)

R DLC SERVO A (H14)

R DLC SERVO B (H15)

R STABILIZER SERVO LB (H16)

R STABILIZER SERVO RC (H17)

R STABILIZER SERVO LA (H18)

R STABILIZER SERVO RD (H19)

R SPOILER SERVO A 2L (J15)

R SPOILER SERVO B 1, 4, 6 L&R (J16)

R SPOILER SERVO C 3, 5 L&R (J17)

SPOILER SERVO D 2 R (J18)

AFCS WARNING CAPT (K18)

AFCS WARNING F/O (K19)

MLG GND SENSE (L8)

(5) On Flight Engineers/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed:

PFCS ADS/DH (G8)

FLT CONT ALT ALERT (G9)

PROXIMITY SWITCH 2 (H3)

PROXIMITY SWITCH 3 (H4)

(6) On FCES panel, depress STALL WARN 1 and 2 to OFF.

(7) On FCES panel, depress DLC/AUTO SPLR 1 and 2 to OFF.

RESULT:

On CAWP, AUTO GND SPLR INOP light comes on.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM;

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic systems A, B, C and D (Ref. 29-11-00).

(9) On PFCS panel, depress following switchlights to on (dark).

STABILIZER A, B, C, and D

SPOILER L&R1, L&R2, L&R3, and L&R4.

R (10) Set flaps to 4.0 degrees.

(11) Set all throttle levers to idle forward thrust (aft).

(12) Set all reverse thrust levers to idle reverse thrust (down).

(13) Set speedbrake lever to full forward, and ensure that lights on lever are off.

(14) Ensure that landing gear control lever is DOWN.

R WARNING: VERIFY THAT STEPS (15) THROUGH (17) HAVE BEEN PERFORMED BEFORE THE THROTTLE LEVERS ARE MOVED TO THE REVERSE THRUST POSITION.

(15) On pilots overhead circuit breaker panel CB1, zone 213, open the following circuit breakers:

THRUST REVERSE

ENG 1 (H16)

ENG 2 (H17)

ENG 3 (H18)

(16) On FE/SO ENGINE BLEED CONTROL panel, depress the three ENG ISLN VALVE switchlights and the three HI PRESS valve switchlights to OFF.

RESULT:

Verify that the switchlights indicate OFF, and the flow bars are dark.

(17) Verify that the thrust reversers on each engine are clear of personnel and equipment before proceeding.

DLC/AGS Fault Isolation
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
PERFORM PRELIMINARY PROCEDURE		
A. DLC SERVO HYDRAULIC PRESSURE (MANUAL MODE) TEST.		

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
1. Center console • If lights on speedbrake lever are on, depress speedbrake automatic disable sw to turn off lights.	Lights on speedbrake lever off.	No test.
2. Move speedbrake lever aft to max position, then to zero.	Force required • Approx 4 lb.	Test OK.
	Force too high (Approx 40-50 lb).	Replace switch and latching mechanism in speedbrake lever (Ref. 27-61-01).
3. CB2, open H15.		No test.
4. Move speedbrake lever aft to max position, then to zero.	Force required • Approx 4 lb.	Test OK.
	Force too high (approx 40-50 lb).	Depress speedbrake automatic disable sw. • If light on lever does not come on, replace sw in speedbrake lever (Ref. 27-61-01). • If one light on lever comes on, check that hyd sys B press is >850 psi. Replace DLC servo channel 1 hyd solenoid valve 6, hyd sys B (Ref. 27-61-08). If problem persists, replace DLC servo (Ref. 27-61-06).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
5. CB 2, close H15, and open H14.		No test.
6. Move speedbrake lever aft to max position, then to zero.	Force required • Approx 4 lb.	Test OK.
	Force too high (approx 40-50 lb).	Depress speedbrake automatic disable sw. • If light on lever does not come on, replace sw in speedbrake lever (Ref. 27-61-01). • If one light on lever comes on, check that hyd sys A press is >850 psi. Replace DLC servo channel 2 hyd solenoid valve 7, hyd sys A (Ref. 27-61-06). If problem persists, replace DLC servo (Ref. 27-61-06).
7. CB2, close H14.		No test.
8. Depress speedbrake automatic disable sw to turn on lights, and depress sw again to turn off lights.	Both lights on speedbrake lever come on, then go off.	Test OK.
	One or both lights do not come on.	Replace light bulb or sw on speedbrake lever.

B. DLC/AUTO SPLR TURN ON.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
1. FCES panel. • Depress DLC/AUTO SPLR 1, 2 to on.	DLC/AUTO SPLR 1, 2 dark. AUTO GND SPLRS INOP light out within 15 sec.	Test OK.
	Both DLC/AUTO SPLR FAIL.	Two faults exist. Turn off DLC/AUTO SPLR 2 and troubleshoot for DLC/AUTO SPLR 1 FAIL. Then turn off system 1, turn on system 2 and troubleshoot for DLC/AUTO SPLR 2 FAIL.
	DLC/AUTO SPLR 1 FAIL.	(a) Remove FCES computer. • If no FAIL, go to Step (c). • If FAIL, go to Step (b). (b) Disconnect P6 and P16 from ILCB. • If no FAIL, replace card J-134 in ILCB. • If FAIL, replace FCES control panel. (c) Replace FCES computer.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		(d) FCES panel, depress STALL WARN 1 to on. (e) PFCS panel, depress PFCS monitor pitch 1 and roll 1 to on. (f) Do all switchlights in Step (d) and (e) FAIL. • Yes, FCES computer power fault. (Ref. 22-17-00, Fig. SCHEM 3). • No, go to Step (g). (g) Replace DLC press sw No. 1 or No. 2 (hyd sys B) (Ref. 27-61-36). (h) FLAP SWITCHES, DLC sys 1A 2751-S2 (2217-S1) or DLC sys 1B 2751-S3 (2217-S2), sw bad, or out of adjustment (Ref. 27-51-55).
	DLC/AUTO SPLR 2 FAIL.	Same as DLC/AUTO SPLR 1 except; Substitute • No. 2 for No. 1. • DLC press sw No. 3 or 4 (hyd sys A) for sw No. 1 or 2 (hyd sys B). • FLAP SWITCHES, DLC sys 1A 2751-S2 (2217-S1), or DLC sys 1B 2751-S3 (2217-S2), or DLC sys 2A 2751-S4 (2217-S3), or DLC sys 2B 2751-S5, (2217-S4), bad or out of adjustment. (Ref. 27-51-55).
	Speedbrake lever does not remain at zero.	Multiple throttle quadrant reverse thrust sw fault, go to Step C (Rejected takeoff test).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	AUTO GND SPLRS INOP light on.	(a) If center instr panel TRUCK light is on, troubleshoot truck unlevel circuit per Step H.
	WARNING: VERIFY THE FOLLOWING BEFORE MOVING LANDING GEAR CONTROL LEVER TO NEUTRAL POSITION: ALL MLG AND NLG DOWNLOCK SAFETY PINS MUST BE INSTALLED. FORWARD FUSELAGE JACK MUST BE IN POSITION FOR JACKING WITH JACK PAD IN CONTACT WITH FORWARD FUSELAGE JACKING ADAPTER. (REF. 7-11-00).	
		(b) Move landing gear control lever to NEUTRAL position. • If AUTO GND SPLRS INOP light goes out go toStep (c). • If light remains on,
R		go to Step (d).
		(c) Hyd "C" press fault. • Replace AFCS/MLG accessory unit. • Replace FCES computer. • Replace MLG control lever (Ref. 32-31-14). • Replace MLG hyd press sw No. 1 or No. 2 (Ref. 32-31-15).
		(d) Turn on NOSE WHEEL well light. If light does not come on, problem is in R and L MLG air/ground sensing system. • Perform BITE test of Logic Card J11 in Prox sw logic box (Ref.
R		31-22-00).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		• Perform BITE test of Logic Cards J7, and J8 in Prox sw card box (Ref. 31-22-00). • Replace ground service control relay 2441-K2 (Ref. 32-63-00). • Check R and L MLG A/G safety sensor (Ref. 32-63-00).
2. Depress DLC/AUTO SPLR 1, 2 to OFF.	AUTO GND SPLRS INOP light on.	No test.
3. Depress DLC/AUTO SPLR 1 to on.	AUTO GND SPLRS INOP light out within 15 sec.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		AUTO GND SPLRS INOP light on.	(a) If center instr panel TRUCK light is on, troubleshoot truck unlevel circuit per Step H.
R			(b) Hyd "C" press fault. • Replace AFCS/MLG accessory unit. • Replace FCES computer. • Replace MLG hyd press sw No. 1 or No. 2 (Ref. 32-31-15).
R R R R			(c) Turn on NOSE WHEEL well light. If light does not come on, problem is in R and L MLG air/ground sensing system. • Perform BITE test of Logic Card J11 in Prox sw logic box (Ref. 31-22-00). • Perform BITE test of Logic Cards J7, and J8 in Prox sw card box (Ref. 31-22-00).
			• Replace ground service control box relay 2441-K2 (Ref. 32-63-00). • Check R and L MLG A/G safety sensor (Ref. 32-63-00)
	4. Depress DLC/AUTO SPLR 1 to OFF, and 2 to on.	AUTO GND SPLRS INOP light out within 15 sec.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		AUTO GND SPLRS INOP light on.	(a) If center instr panel TRUCK light is on, troubleshoot truck unlevel circuit per Step H.
R			(b) Hyd "C" press fault. • Replace AFCS/MLG accessory unit. • Replace FCES computer. • Replace MLG control lever (Ref. 32-31-14). • Replace MLG hyd press sw No. 1 or No. 2 (Ref. 32-31-15).
R R R R			(c) Turn on NOSE WHEEL well light. If light does not come on, problem is in R and L MLG air/ground sensing system. • Perform BITE test of Logic Card J11 in Prox sw logic box (Ref. 31-22-00). • Perform BITE test of Logic Cards J7, and J8 in Prox sw card box (Ref. 31-22-00). • Replace ground service control relay 2441-K2 (Ref. 32-63-00). • Check R and L MLG A/G safety sensor (Ref. 32-63-00).

C. REJECTED TAKEOFF TEST.

WARNING: CLEAR THRUST REVERSERS ON EACH ENGINE OF PERSONNEL AND EQUIPMENT BEFORE PROCEEDING WITH PROCEDURE.

R DLC/AGS Fault Isolation (Cont)
R Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
NOTE: When checking channel 1, spoilers 1, 2, 3, 4 L and R fully deploy and speed brake handle travels full stroke. When checking channel 2, spoilers 2, 3, 4, L and R fully deploy. Spoilers 1 L and R deploy approximately 50 degrees and speed brake handle travels approximately 1 to 1.5 inches less than full stroke. Rate of speed brake handle travel at start of movement under both conditions is approximately the same. Channel 2 handle travel rate is slower during the last portion of handle motion.		
1. Depress DLC/AUTO SPLR 1 to on.		No test.
2. Pull No. 1 reverse thrust lever up to idle reverse thrust position.	Spoilers remain at zero.	Test OK.
	Spoilers deploy to max position.	(a) Replace FCES computer. (b) ENG No. 2 or No. 3 THROTTLE SWITCHES • RTO-sys A 2217-S7 sw bad or out of adjustment (Ref. 76-11-06).
3. Pull No. 2 reverse thrust lever up to idle reverse thrust position.	Spoilers deploy to max position.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Spoilers remain at zero position.	(a) Pull No. 3 reverse thrust lever up to idle thrust position. • If spoilers deploy, ENG No. 1 or No. 2 THROTTLE SWITCHES RTO-SYS A 2217-S7 sw bad or out of adjustment. (Ref. 76-11-06). (b) Replace FCES computer (Ref. 22-17-01). (c) Replace FCES control panel (Ref. 22-10-07). (d) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (e) Replace DLC press sw No. 1 (hyd sys B) (Ref. 27-61-36). (f) Replace DLC solenoid valve No. 1, No. 2, No. 3 (hyd sys B) (Ref. 27-61-08). (g) Replace DLC servo EHV (Channel No. 1) (hyd sys B) (Ref. 27-61-07). (h) Replace DLC servo. (Ref. 27-61-06).
	DLC/AUTO SPLR 1 FAIL.	(a) Replace FCES computer. (b) Replace DLC press sw No. 1 (hyd sys B) (Ref. 27-61-36). (c) Replace DLC servo (Ref. 27-61-06).
4. Return No. 1 reverse thrust lever to idle forward thrust position.	Spoilers retract to zero position.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Spoilers remain at max position.	(a) Replace FCES computer (b) ENG No. 1 THROTTLE SWITCHES • RTO-sys A 2217-S7 sw bad or out of adjustment (Ref. 76-11-06).
5. Pull No. 3 reverse thrust lever up to idle reverse thrust position.	Spoilers deploy to max position.	Test OK.
	Spoilers remain at zero position.	ENG No. 3 THROTTLE SWITCHES • RTO-SYS A 2217-S7 sw bad or out of adjustments (Ref. 76-11-06).
6. Return No. 2 reverse thrust lever to idle forward thrust position.	Spoilers retract to zero position.	No test.
7. Pull No. 1 reverse thrust lever up to idle reverse thrust position.	Spoilers deploy to max position.	Test OK.
	Spoilers remain at zero position.	Replace FCES computer.
8. Return No. 1 and 3 reverse thrust levers to idle forward thrust position.	Spoilers retract to zero position.	No test.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
9. Depress DLC/AUTO SPLR 1 to OFF and 2 to on.	Spoilers retract to zero position.	No test.
10. Pull No. 1 reverse thrust lever up to idle reverse thrust position.	Spoilers remain at zero position.	Test OK.
	Spoilers deploy to max position.	(a) Replace FCES computer. (b) ENG. NO. 2 or No. 3 THROTTLE SWITCHES. • RTO-sys B 2217-S8. Sw bad or out of adjustment (Ref. 76-11-06).
11. Pull No. 2 reverse thrust lever up to idle reverse thrust position.	Spoilers deploy to max position. (See NOTE prior to Step 1).	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Spoilers remain at zero position	(a) Pull No. 3 reverse thrust lever up to idle thrust position. • If spoilers deploy, ENG No. 1 or No. 2 THROTTLE SWITCHES RTO-SYS B 2217-S8 sw bad or out of adjustment (Ref. 76-11-06).
		R (b) Replace FCES computer (Ref. 22-17-01).
		R (c) Replace FCES control panel (Ref. 22-10-07).
		R (d) Replace AFCS/MLG accessory unit (Ref. 22-10-11).
		R (e) Replace DLC press sw No. 3 (hyd sys A) (Ref. 27-61-36).
		R (f) Replace DLC solenoid valve No. 4, No. 5 (hyd sys A) (Ref. 27-61-08).
		R (g) Replace DLC servo EHV (Channel No. 2) (hyd sys A) (Ref. 27-61-07).
		R (h) Replace DLC servo (Ref. 27-61-06).
	DLC/AUTO SPLR 2 FAIL.	(a) Replace FCES computer.
		R (b) Replace DLC press sw No. 3 (hyd sys A) (Ref. 27-61-36).
		R (c) Replace DLC servo. (Ref. 27-61-06).
12. Return No. 1 reverse thrust lever to idle fwd thrust position.	Spoilers retract to zero position.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R		Spoilers remain at max position.	(a) Replace FCES computer. (b) ENG No. 1 THROTTLE SWITCHES. • RTO-Sys B 2217-S8. Sw bad or out of adjustment (Ref. 76-11-06).
	13. Pull No. 3 reverse thrust lever up to idle reverse thrust position.	Spoilers deploy to max position.	Test OK.
		Spoilers remain at zero position.	ENG No. 3 THROTTLE SWITCHES • RTO-SYS B 2217-S8 sw bad or out of adjustment (Ref. 76-11-06).
	14. Return No. 2 reverse thrust lever to idle fwd thrust position.	Spoilers retract to zero position.	No test.
	15. Pull No. 1 reverse thrust lever up to idle reverse thrust position.	Spoilers deploy to max position.	Test OK.
		Spoilers remain at zero.	Replace FCES computer.
	16. Return No. 1 and 3 reverse thrust levers to idle fwd thrust position.	Spoilers retract to zero position.	No test.
	17. Depress DLC/AUTO SPLR 2 to OFF.	AUTO GND SPLRS INOP light on.	No test.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
18. On CB1, close H16, H17 and H18.		No test.
D. LANDING GEAR HANDLE PLUS MLG HYDRAULIC "C" PRESSURE (SINGLE CHANNEL) TEST.		
1. Ensure that flaps are set to less than 30 deg.		No test.
2. Move all throttle levers to idle thrust position.		No test.
3. Ensure LANDING GEAR control lever is in DOWN position.		No test.
4. Depress DLC/AUTO SPLR 1 to on.	No spoiler movement. AUTO GND SPLRS INOP light off within 15 sec.	No test.
5. Turn off hyd sys "C" (Ref. 29-11-00).	CAWP • AUTO GND SPLRS INOP light on	Test OK.
	AUTO GND SPLRS INOP light not on.	(a) Replace FCES computer. (b) Replace AFCS/MLG accessory unit. (c) Replace MLG hyd press sw No. 1 or No. 2 (Ref. 32-31-15).
6. Turn on hyd sys "C" (Ref. 29-11-00).	CAWP • AUTO GND SPLRS INOP light out.	No test.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
WARNING: VERIFY THE FOLLOWING BEFORE MOVING LANDING GEAR CONTROL LEVER TO NEUTRAL POSITION: ALL MLG AND NLG DOWNLOCK SAFETY PINS MUST BE INSTALLED. FORWARD FUSELAGE JACK MUST BE IN POSITION FOR JACKING WITH JACK PAD IN CONTACT WITH FORWARD FUSELAGE JACKING ADAPTER. (REF. 7-11-00).		
7. Move LANDING GEAR control lever to NEUTRAL position.		No test.
8. Turn off hyd sys "C".	CAWP • AUTO GND SPLRS INOP light does not come on.	Test OK.
	AUTO GND SPLRS INOP light on.	(a) Replace AFCS/MLG accessory unit. (b) Replace MLG control lever (Ref. 32-31-14). (c) Replace MLG hyd press sw No. 1 or No. 2 (Ref. 32-31-15)
9. Turn on hyd sys "C."		No test.
10. Move LANDING GEAR control lever to DOWN position.		No test.
11. Depress DLC/AUTO SPLR 1 to OFF, and DLC/AUTO SPLR 2 to on.	No spoiler movement. AUTO GND SPLRS INOP light off within 15 sec.	No test.
12. Turn off hyd sys "C."	CAWP • AUTO GND SPLRS INOP light on.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	AUTO GND SPLRS INOP light not on.	(a) Replace AFCS/MLG accessory unit. (b) Replace FCES computer. (c) Replace MLG hyd press sw No. 2 or No. 1 (Ref. 32-31-15).
13. Turn on hyd sys "C."	CAWP • AUTO GND SPLRS INOP light out.	No test.
WARNING: VERIFY THE FOLLOWING BEFORE MOVING LANDING GEAR CONTROL LEVER TO NEUTRAL POSITION: ALL MLG AND NLG DOWNLOCK SAFETY PINS MUST BE INSTALLED. FORWARD FUSELAGE JACK MUST BE IN POSITION FOR JACKING WITH JACK PAD IN CONTACT WITH FORWARD FUSELAGE JACKING ADAPTER. (REF. 7-11-00). 14. Move LANDING GEAR control lever to NEUTRAL position.		No test.
15. Turn off hyd sys "C."	CAWP • AUTO GND SPLRS INOP light does not come on.	Test OK.
	AUTO GND SPLRS INOP light on.	(a) Replace AFCS/MLG accessory unit. (b) Replace MLG control lever (Ref. 32-31-14). (c) Replace MLG hyd press sw No. 1 or No. 2 (Ref. 32-31-15).
16. Turn on hyd sys "C."		No test.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
17. Move LANDING GEAR control lever to DOWN position.		No test.
18. Depress DLC/AUTO SPLR 2 to OFF.	CAWP • AUTO GND SPLRS INOP light on.	No test.
E. FLAT LANDING SENSOR (OLEO) (SINGLE CHANNEL) TEST. NOTE: When checking channel 1, spoilers 1, 2, 3, 4 L and R fully deploy and speed brake handle travels full stroke. When checking channel 2, spoilers 2, 3, 4 L and R fully deploy. Spoilers 1 L and R deploy approximately 50 degrees and speed brake handle travels approximately 1 to 1.5 inches less than full stroke. Rate of speed brake handle travel at start of movement under both conditions is approximately the same. Channel 2 handle travel rate is slower during the last portion of handle motion.		
1. Set flaps to 33 deg.		No test.
2. Depress DLC/AUTO SPLR 1 to on.	Spoiler deploy to max position.	Test OK.
	Spoilers deploy to DLC neutral. AUTO GND SPLRS INOP light on.	(a) If cargo doors will not open, problem in NLG A/G sensing system. • Perform BITE Test of Logic Card J9 and Driver J3 in Prox sw card box (Ref. 31-22-00). • Check NLG A/G safety sensor (Ref. 32-63-00). (b) Replace FCES computer (Ref. 22-17-01).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	No spoiler deployment.	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (c) FLAP SWITCHES • DLC sys 1A 2751-S2 (2217-S1), or DLC sys 1B 2751-S3 (2217-S2) sw bad or out of adjustment (Ref. 27-51-55).
	Spoilers deploy to max. After a delay spoilers move to DLC neutral with AUTO GND SPLRS INOP light. After a further delay, DLC/AUTO SPLR 1 FAIL.	(a) Truck tilt, fault isolate using Step H. (b) Replace FCES computer (Ref. 22-17-01). (c) Replace AFCS/MLG accessory unit (Ref. 22-10-11).
3. Depress DLC/AUTO SPLR 1 to OFF.	AUTO GND SPLRS INOP light on.	No test.
4. Move speedbrake lever to zero.		No test.
5. Depress DLC/AUTO SPLR 2 to on.	Spoilers deploy to max. (See NOTE prior to Step 1).	Test OK.
	Spoilers deploy to DLC neutral. AUTO GND SPLRS INOP light on.	Replace FCES computer (Ref. 22-17-01).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	No spoiler deployment.	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (c) FLAP SWITCHES • DLC sys 2A 2751-S4 (2217-S3), or DLC sys 2B 2751-S5 (2217-S4) sw bad or out of adjustment (Ref. 27-51-55).
	Spoilers deploy to max. After a delay spoilers move to DLC neutral with AUTO GND SPLRS INOP light. After a further delay, DLC/AUTO SPLR 1 FAIL.	(a) Truck tilt, fault isolate using Step H. (b) Replace FCES computer. (c) Replace AFCS/MLG accessory unit (Ref. 22-10-11).
6. Depress DLC/AUTO SPLR 2 to OFF.	AUTO GND SPLRS INOP light on.	No test.
7. Move speedbrake lever to zero.		No test.
8. Set flaps to 22 deg.	On aircraft with 27 deg detent, set flaps to 27 deg.	No test.
	F. DLC (SINGLE CHANNEL) TEST.	
1. FCES panel • Depress DLC/AUTO SPLR 1, 2 to OFF if on.	DLC/AUTO SPLR • Lights OFF. CAWP • AUTO GND SPLRS INOP light on.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R R R R R R		AUTO GND SPLRS INOP light off.	Perform lamp check (Ref. 22-02-01). Replace FCES computer (Ref. 22-17-01). Replace FCES control panel (Ref. 22-10-07).
R	2. FESC, center rack. • Remove AFCS/MLG accessory unit.	Simulates aircraft airborne.	No test.
	3. Set throttle levers to less than takeoff.		No test.
	4. Set flaps to 33 deg.		No test.
	NOTE: DLC neutral is defined as the aft edge of the speedbrake lever in the approximate center of the DLC range marking.		
	5. Depress DLC/AUTO SPLR 1 to on.	Spoiler L and R panels 1, 2, 3, 4. • Deploy to DLC neutral in approx 10 sec. SPI • SPOILER DLC neutral. Speedbrake Lever. • Moves to DLC neutral and stops.	Test OK.
R R R R R R		DLC/AUTO SPLR 1 FAIL.	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace trim aug computer. (c) Replace FCES control panel (Ref. 22-10-07). (d) Replace speed control computer (Ref. 22-31-07).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R		(e) Replace DLC press sw No. 2 (hyd sys B) (Ref. 27-61-36). (f) Replace DLC solenoid valve No. 3 (hyd sys B) (Ref. 27-61-08). (g) Replace DLC servo (Ref. 27-61-06). (h) Check auto trim with autopilot A engaged, (Ref. 22-18-00). • If fail, replace stabilizer autopilot control servo (Ref. 22-11-05).
	No spoiler deployment.	(a) Replace FCES computer (Ref. 22-17-01). (b) Go around mode input. • Disengage go around mode. • Replace pitch computer No. 1 or No. 2 (Ref. 22-11-01). (c) Two throttle lever sw bad, or out of adjustment (Ref. 76-11-06).
6. Either control wheel, move control column. • Full fwd. • Center. • Full aft. • Center.	Spoiler Movement • DLC max, then DLC neutral. • DLC zero, then DLC neutral. • DLC zero, then DLC neutral. • DLC max, then DLC neutral.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	DLC/AUTO SPLR 1 FAIL.	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace trim aug computer (Ref. 22-18-01). (c) Replace speed control computer (Ref. 22-31-07). (d) Replace DLC servo EHV (Channel No. 1) (hyd sys B) (Ref. 27-61-07). (e) Check 26 vac power (Ref. 22-17-00, Fig 103). (f) Check auto trim with autopilot A, per Section 30. • If fail, replace stabilizer autopilot control servo (Ref. 22-11-05). (g) Replace DLC servo (Ref. 27-61-06).
7. Move No. 1 throttle lever to full fwd thrust position.	Spoilers remain at DLC neutral.	Test OK.
	Spoilers retract.	(a) Replace FCE computer (Ref. 22-17-01). (b) ENG No. 2 or No. 3 THROTTLE SWITCHES. • DLC-sys A 2217-S6 sw bad or out-of-adjustment (Ref. 76-11-06). (Ref. 76-11-00).

R

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
8. Slowly move No. 2 throttle lever toward full fwd thrust position, and stop when spoilers start to retract.	Spoilers start to retract at >7 on 0-10 scale adjacent to throttle lever.	Test OK.
	Spoilers start to retract before 7.	ENG No. 2 THROTTLE SWITCHES. • DLC - sys A 2217-S6 sw bad or out of adjustment (Ref. 76-11-06).
	Spoilers remain at DLC neutral.	(a) Replace FCES computer (Ref. 22-17-01). (b) ENG No. 1 or No. 2 THROTTLE SWITCHES. • DLC - sys A 2217-S6 sw bad or out of adjustment (Ref. 76-11-06).
9. Return No. 1 throttle lever to idle thrust position.	Spoilers move to DLC neutral.	Test OK.
	Spoilers remain at zero.	(a) Replace FCES computer (Ref. 22-17-01). (b) ENG No. 1 THROTTLE SWITCHES. • DLC-sys A 2217-S6 sw bad or out of adjustment (Ref. 76-11-00).
10. Slowly move No. 3 throttle lever toward full fwd thrust position, and stop when spoilers start to retract.	Spoilers start to retract at >7.	Test OK.

R

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Spoilers start to retract before 7, or remain at DLC neutral.	ENG No. 3 THROTTLE SWITCHES • DLC-sys A 2217-S6 sw bad or out of adjustment (Ref. 76-11-00).
11. Return No. 2 throttle lever to idle thrust position.	Spoilers move to DLC neutral.	No test.
12. Slowly move No. 1 throttle lever towards full fwd thrust position, and stop when spoilers start to retract.	Spoilers start to retract at >7.	Test OK.
	Spoilers start to retract before 7.	ENG No. 1 THROTTLE SWITCHES. • DLC-sys A 2217-S6 sw bad or out of adjustment (Ref. 76-11-06).
13. Return No. 1 and 3 throttle levers to thrust position.	Spoilers move to DLC neutral.	No test.
14. Set flaps to 22 deg. On airplanes with 27 deg detent, set flaps to 27 deg.	Spoilers retract.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	DLC/AUTO SPLR 1 FAIL or no spoiler retraction.	(a) FLAP SWITCHES • DLC sys 1A 2751-S2 (2217-S1), or DLC sys 1B 2751-S3 (2217-S2) sw bad, or out of adjustment. (Ref. 27-51-55). (b) Replace FCES computer (Ref. 22-17-01).
15. Set flaps to 33 deg.	Spoilers deploy to DLC neutral.	Test OK.
	DLC/AUTO SPLR 1 FAIL or no spoiler deployment.	(a) FLAP SWITCHES • DLC sys 1A 2751-S2 (2217-S1), or DLC sys 1B 2751-S3 (2217-S2) sw bad or out of adjustment (Ref. 27-51-55). (b) Replace FCES computer (Ref. 22-17-01).
16. Depress DLC/AUTO SPLR 1 to OFF.		No test.
17. Manually move speedbrake lever to 0.		No test.
18. Depress DLC/AUTO SPLR 2 to on.	Spoiler L and R panels 1, 2, 3, 4. • Deploy to DLC neutral in approx 10 sec. SPI • SPOILER DLC neutral Speedbrake Lever • Moves to DLC neutral and stops.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	DLC/AUTO SPLR 2 FAIL	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace trim aug computer (Ref. 22-18-01). (c) Replace FCES control panel (Ref. 22-10-07). (d) Replace speed control computer (Ref. 22-31-07). (e) Replace DLC press sw No. 4 (hyd sys A) (Ref. 27-61-36). (f) Replace DLC solenoid valve No. 5 (hyd sys A) (Ref. 27-61-08). (g) Replace DLC servo (Ref. 27-61-06). (h) Check auto trim with autopilot B engaged (Ref. 22-18-00). • If fail, replace stabilizer autopilot control servo, (Ref. 22-11-05).
R	No spoiler deployment	(a) Replace FCES computer (Ref. 22-17-01). (b) Go around mode input. • Disengage go around mode. • Replace pitch computers No. 1 or No. 2 (Ref. 22-11-01). (c) Two throttle lever sw bad, or out of adjustment (Ref. 76-11-00).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
19. Either control wheel, move control column • Full fwd. • Center. • Full aft. • Center.	Spoiler Movement • DLC max, then DLC neutral. • DLC zero, then DLC neutral. • DLC zero, then DLC neutral. • DLC max, then DLC neutral.	Test OK.
	DLC/AUTO SPLR 2 FAIL.	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace trim aug computer (Ref. 22-18-01). (c) Replace speed control computer (Ref. 22-31-07). (d) Replace DLC servo EHV (Channel No. 2) (hyd sys A) (Ref. 27-61-07). (e) Check 26 vac power (Ref. 22-17-00, Fig. 103). (f) Check auto trim with autopilot A engaged (Ref. 22-18-00). • If fail, replace stabilizer autopilot control servo (Ref. 22-11-05). (g) Replace DLC servo (Ref. 27-61-06).
20. Move No. 1 throttle lever to full fwd thrust position.	Spoilers remain at DLC neutral	Test OK.

R

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Spoilers retract.	(a) Replace FCES computer. (b) ENG No. 2 or No. 3 THROTTLE SWITCHES. R • DLC-sys B 2217-S9 sw R bad or out-of-adjustment (Ref. 76-11-06).
21. Slowly move No. 2 throttle lever toward full fwd thrust position, and stop when spoilers start to retract.	Spoilers start to retract at >7 on 0-10 scale adjacent to lever.	Test OK.
	Spoilers start to retract before 7.	ENG No. 2 THROTTLE SWITCHES. • DLC-sys B 2217-S9 sw bad or out of adjustment (Ref. 76-11-00).
	Spoilers remain at DLC neutral.	R (a) Replace FCES R computer (Ref. 22-17-01). (b) ENG No. 1 or No. 2 THROTTLE SWITCHES. R • DLC-sys B 2217-S9 sw R bad or out of adjustment (Ref. 76-11-06).
22. Return No. 1 throttle lever to idle thrust position.	Spoilers move to DLC neutral.	Test OK.
	Spoilers remain at zero.	R (a) Replace FCES R computer (Ref. 22-17-01). (b) ENG No. 1 THROTTLE SWITCHES R • DLC-sys B 2217-S9 sw R bad or out of adjustment (Ref. 76-11-06).

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	23. Slowly move No. 3 throttle lever toward full fwd thrust position, and stop when spoilers start to retract	Spoilers start to retract at >7.	Test OK.
R R		Spoilers start to retract before 7, or remain at DLC neutral.	ENG No. 3 THROTTLE SWITCHES • DLC-sys B 2217-S9 sw bad or out of adjustment (Ref. 76-11-06).
	24. Return No. 2 throttle lever to idle thrust position.	Spoilers move to DLC neutral.	No test.
	25. Slowly move No. 1 throttle lever towards full fwd thrust position, and stop when spoilers start to retract.	Spoilers start to retract at >7.	Test OK.
R R		Spoilers start to retract before 7.	ENG No. 1 THROTTLE SWITCHES. • DLC-sys B 2217-S9 sw bad or out of adjustment (Ref. 76-11-06).
	26. Return No. 1 and 3 throttle levers to thrust position.	Spoilers move to DLC neutral.	No test.
	27. Set flaps to 22 deg. On airplanes with 27 degree detent, set flaps to 27 deg.	Spoilers retract.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		DLC/AUTO SPLR 2 FAIL or no spoiler retraction.	(a) FLAP SWITCHES • DLC sys 2A 2751-S4 (2217-S3), or DLC sys 2B 2751-S5 (2217-S4) sw bad, or out of adjustment (Ref. 27-51-55). (b) Replace FCES computer (Ref. 22-17-01).
R R	28. Set flaps to 33 deg.	Spoilers deploy to DLC neutral.	Test OK.
		DLC/AUTO SPLR 2 FAIL or no spoiler deployment.	(a) FLAP SWITCHES • DLC sys 2A 2751-S4 (2217-S3), or DLC sys 2B 2751-S5 (2217-S4) sw bad, or out of adjustment (Ref 27-51-55). (b) Replace FCES computer (Ref. 22-17-01).
R R	29. Depress DLC/AUTO SPLR 2 to OFF.		No test.
	30. Manually move speedbrake lever to 0.		No test.
	31. Install AFCS/MLG accessory unit.	Aircraft on ground.	No test.
	G. STROKE LIMITER (DUAL CHANNEL)		
	1. Move all throttle levers to idle thrust.		No test.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	2. Place aluminum shim in oleo prox sensor on NLG (Ref. 32-63-00).	Simulates NLG airborne.	No Test.
	3. Set flaps to 33 deg.		No test.
	4. Depress DLC/AUTO SPLR 1, 2 to on.	Within 15 sec, AUTO GND SPLRS INOP light on, and both DLC/AUTO SPLR FAIL.	Test OK.
R R R R		No FAIL and spoilers deploy to maximum.	(a) Replace FCES computer (Ref. 22-17-01). (b) If cargo door will not open, problem is in NLG A/G sensing system. • Perform BITE test of Logic Card J9 and Driver J3 in Prox sw card box (Ref. 31-22-00). • Check NLG A/G safety sensor (Ref. 32-63-00).
	5. Depress DLC/AUTO SPLR 1, 2 to OFF.		No test.
	6. Remove aluminum shim from NLG sensors.		No test.

H. FLAP LEVER AND THROTTLE LEVER RESET OF TRUCK TILT SENSORS TEST.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
NOTE: When checking channel 1, spoilers 1, 2, 3, 4 L and R fully deploy and speed brake handle travels full stroke. When checking channel 2, spoilers 2, 3, 4 L and R fully deploy. Spoilers 1 L and R deploy approximately 50 degrees and speed brake handle travels approximately 1 to 1.5 inches less than full stroke. Rate of speed brake handle travel at start of movement under both conditions is approximately the same. Channel 2 handle travel rate is slower during the last portion of handle motion.		
1. Set flap to 22 deg. On aircraft with 27 deg. detent, set flaps to 27 deg.		No test.
2. Place aluminum shims in all oleo prox sensors (NLG, and both MLG) (Ref. 32-63-00).	Simulates aircraft airborne.	No test.
3. Set flaps to 33 deg.	No spoiler deployment.	No test.
4. Place steel shims in both truck sensors on each L and R MLG (Ref. 32-63-00).		No test.
5. Depress DLC/AUTO SPLR 1 to on.	Spoilers deploy to max position.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R		Spoilers deploy to 3/4 max and return to DLC neutral after a short delay. AUTO GND SPLRS INOP light comes on.	(a) Perform visual inspection of all truck unlevel sensor targets, before troubleshooting. (b) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (c) Replace FCES computer (Ref. 22-17-01). (d) Perform BITE test of Logic Cards J3 and J5 in Prox sw Logic box (Ref. 31-22-00). (Ref. 31-22-04). (e) Perform BITE test of Logic Cards J13 and J28 in Prox sw Card box (Ref. 31-22-00). (f) Remove steel shim from outboard truck unlevel sensor on R MLG. • If TRUCK light on center instr panel goes out, check inboard truck unlevel sensor on L MLG (Ref. 32-61-00). (g) Install steel shim in outboard truck unlevel sensor on R MLG. (h) Remove steel shim from inboard truck unlevel sensor on L MLG. • If TRUCK light goes out, check outboard truck unlevel sensor on R MLG (Ref. 32-61-00). (i) Check outboard truck unlevel sensor on L MLG and inboard truck unlevel sensor on R MLG (Ref. 32-61-00).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
6. Remove steel shims from L and R MLG truck sensors.	Spoilers remain at max position.	Test OK.
	DLC/AUTO SPLRS 1 FAIL.	(a) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (b) Replace FCES computer (Ref. 22-17-01).
7. Set flaps to 22 deg (27 deg), then to 33 deg.	Spoilers return to zero then DLC neutral position.	Test OK.
R	Spoilers remain at max position.	(a) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (b) FLAP SWITCHES, • DLC sys 1A 2751-S2 (2217-S1), or DLC sys 1B 2751-S3 (2217-S2) sw bad or out of adjustment (Ref. 27-51-55). (c) Replace FCES computer (Ref. 22-10-11).

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	DLC/AUTO SPLR 1 FAIL.	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (c) FLAP SWITCHES, • DLC sys 1A 2751-S2 (2217-S1), or DLC sys 1B 2751-S3 (2217-S2) bad or out of adjustment (Ref. 27-51-55). (d) Truck unlevel ckt fault. • Perform truck troubleshooting in Step 5.
8. Depress DLC/AUTO SPLR 1 to OFF. NOTE: On aircraft without SB 22-019, skip Steps 9 through 15.	AUTO GND SPLRS INOP light on.	No test.
9. Manually set speedbrake lever to zero.		No test.
10. Place steel shims in both truck sensors of L and R MLG (Ref. 32-63-00).		No test.
11. Depress DLC/AUTO SPLR 1 to on.	Spoilers deploy to max position.	No test.
12. Remove steel shims from L and R MLG truck sensors.	Spoilers remain at max position.	No test.

DLC/AGS Fault Isolation (Cont)
Table 501

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	13. Set all throttle levers to full fwd, then to flight idle position.	Spoilers return to zero, then to DLC neutral.	Test OK.
R R		DLC/AUTO SPLR 1 FAIL.	(a) Check throttle levers per Step F. (b) Replace FCES computer (Ref. 22-17-01).
	14. Depress DLC/AUTO SPLR 1 to OFF.	AUTO GND SPLRS INOP light on.	No test.
	15. Set speedbrake lever to zero.		No test.
	16. Place steel shims in both truck sensors on each L and R MLG (Ref. 32-63-00).		No test.
	17. Depress DLC/AUTO SPLR 2 to on.	Spoilers deploy to max position.	Test OK.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Spoilers deploy to 3/4 max and return to DLC neutral after a short delay. AUTO GND SPLRS INOP light comes on.	(a) Perform visual inspection of all truck unlevel sensor targets, before troubleshooting. (b) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (c) Replace FCES computer (Ref. 22-17-01). (d) Perform BITE test of Logic Cards J3 and J5 in Prox sw Logic box (Ref. 31-22-04). (e) Perform BITE test of Logic Cards J13 and J28 in Prox sw Card box (Ref. 31-22-00). (f) Remove steel shim from outboard truck unlevel sensor on R MLG. • If TRUCK light on center instr panel goes out, check inboard truck unlevel sensor on L MLG (Ref. 32-61-00). (g) Install steel shim in outboard truck unlevel sensor on R MLG. (h) Remove steel shim from inboard truck unlevel sensor on L MLG. • If TRUCK light goes out, check outboard truck unlevel sensor on R MLG (Ref. 32-61-00). (i) Check outboard truck unlevel sensor on L MLG and R MLG (Ref. 32-61-00).

R

R DLC/AGS Fault Isolation (Cont)
R Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
18. Remove steel shims from L and inboard truck unlevel sensor on R MLG truck sensors.	Spoilers remain at max position.	Test Ok.
	DLC/AUTO SPLR 2 FAIL.	(a) Replace FCES computer (Ref. 22-17-00). (b) Replace AFCS/MLG accessory unit (Ref. 22-10-11).
19. Set flaps to 22 deg (27 deg). Then to 33 deg.	Spoilers return to zero then DLC neutral position.	Test OK.
	Spoilers remain at max position.	(a) Replace AFCS/MLG accessory unit (Ref. 22-10-11). (b) FLAP SWITCHES • DLC sys 2A 2751-S4 (2217-S3), DLC sys 2B 2751-S5 (2217-S4) sw bad or out of adjustment (Ref. 27-51-55).
	DLC/AUTO SPLR 2 FAIL.	(a) Replace FCES computer (Ref. 22-17-01). (b) Replace AFCS/MLG accessory unit (Ref. 22-17-01). (c) FLAP SWITCHES • DLC sys 2A 2751-S4 (2217-S3) or DLC sys 2B 2751-S5 (2217-S4) sw bad or out of adjustment (Ref. 27-51-55).
20. Depress DLC/AUTO SPLR 2 to OFF.	AUTO GND SPLRS INOP light on.	No test.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
NOTE: On aircraft without SB 22-019, skip Steps 21 through 27.		
21. Set speedbrake lever to zero.		No test.
22. Place steel shims in both truck sensors of L and R MLG (Ref. 32-63-00).		No test.
23. Depress DLC/AUTO SPLR 2 to on.	Spoilers deploy to max position.	No test.
24. Remove all steel shims from L and R MLG truck sensors.	Spoilers remain at max position.	No test.
25. Set all throttle levers to full fwd, then to flight idle position.	Spoilers return to zero, then to DLC neutral.	Test OK.
	DLC/AUTO SPLR 2 FAIL.	(a) Check throttle levers per Step F. (b) Replace FCES computer (Ref. 22-17-01).
26. Depress DLC/AUTO SPLR 2 to OFF.	AUTO GND SPLRS INOP light on.	No test.
27. Set speedbrake lever to zero.		No test.

DLC/AGS Fault Isolation (Cont)
Table 501

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
28. Remove all aluminum shims from all oleo Prox Sensors (NLG and both MLG).		No test.
29. Set flaps to 0 deg.		No test.

CR DIRECT LIFT CONTROL/AUTO GROUND SPEED BRAKE - TROUBLESHOOTING

CR 1. Referenced Procedures

CR 22-17-00 Wiring Diagram Manual Schem. 11

CR 31-22-00 Wiring Diagram Manual Schem. 1, 4, 5

CR 32-63-00 Wiring Diagram Manual Schem. 1, 3

CR 24-00-00 Electrical Power - Maintenance Practices

CR 29-11-00 Hydraulic Power - Maintenance Practices

CR 2. Procedures

CR A. Prerequisites

CR (1) No hydraulic pressure.

CR (2) Throttles at idle.

CR (3) Landing gear handle down.

CR (4) No targets set.

CR B. Troubleshooting

CR (1) Use TWA breakout boxes (EQ1196) to make logic
CR measurements at FCES computer.

CR (2) No order of logic measurements is required; any or all
CR may be checked.

CR (3) Refer to following table:

CR DLC/AGSB Breakout Box Logic Tables
CR Table 501

CR Flap Logic

Pin No.	Flaps 22 Deg.	Flaps 33 Deg.*
P1A-47	LO Open	HI 28VDC
P2A-47	LO Open	HI 28VDC
P1B-19	LO Gnd	HI 28VDC
P2B-19	LO Gnd	HI 28VDC

* All logic should change at approximately the same time before flaps reach 33 Deg.

NLG Logic

Pin No.	Normal Weight on Gear	Targets on NLG Squat Sensor
P1A-46	LO	HI
P2A-46	LO	HI

L MLG Squat Logic

Pin No.	Normal Weight on Gear	Targets on L MLG Squat Sensor
P1A-49	HI	LO
P2A-49	HI	LO

DLC/AGSB Breakout Box Logic Tables (Cont)
Table 501

R MLG Squat
Logic

Pin No.	Normal Weight on Gear	Targets on R MLG Squat Sensor
P1B-8	HI	LO
P2B-8	HI	LO

FCES Cont. and Hyd. Press. Logic

NOTE: Before moving LDG handle, all gears must have gear pins installed and a nose fuselage jack must be used under the aircraft nose per applicable Maintenance Manual procedure.

Pin No.	No HYD Press "C" Gear HDL DN	No HYD Press "C" Gear HDL NEUT	HYD Press "C" Gear HDL DN
P1B-4	LO	HI	HI
P2B-4	LO	HI	HI
P3A-16	LO	HI	HI
P3B-19	LO	HI	HI

C DLC/AGSB Breakout Box Logic Tables (Cont)
C Table 501

C L Truck Level

C NOTE: Throttles must be at idle.

Pin No.	Flaps 22 Deg. No Targets	Targets on L MLG Tilt Sws - Flaps 33 deg.	***Flaps 22 Deg. No Targets
P1B-25	LO	**HI	LO
P2B-25	LO	**HI	LO
P1A-51	LO	**HI	LO
P2A-51	LO	**HI	LO

C R Truck Level

C NOTE: Throttles must be at idle.

Pin No.	Flaps 22 Deg. No Targets	Targets on R MLG Tilt Sws - Flaps 33 deg.	***Flaps 22 Deg. No Targets
P1A-6	LO	**HI	LO
P2A-6	LO	**HI	LO
P1B-6	LO	**HI	LO
P2B-6	LO	**HI	LO

CR ** Remove targets and logic remains the same.
CR ***If throttle switches are suspected of not resetting MLG
CR tilt logic, advance throttles instead of raising flaps to
CR check logic reset.

CR DLC/AGSB Breakout Box Logic Tables (Cont)
CR Table 501

CR R MLG Squat Logic

Pin No.	Normal Weight on Gear	Targets on R MLG Squat Sensor
P1B-8	HI	LO
P2B-8	HI	LO

CR FCES Cont. and Hyd. Press. Logic

CR NOTE: Before moving LDG handle, all gears must have gear pins installed and a nose fuselage jack must be used under the aircraft nose per applicable Maintenance Manual procedure.

Pin No.	No HYD Press "C" Gear HDL DN	No HYD Press "C" Gear HDL NEUT	HYD Press "C" Gear HDL DN
P1B-4	LO	HI	HI
P2B-4	LO	HI	HI
P3A-16	LO	HI	HI
P3B-19	LO	HI	HI

CR DLC/AGSB Breakout Box Logic Tables (Cont)
CR Table 501

CR L Truck Level

CR NOTE: Throttles must be at idle.

Pin No.	Flaps 22 Deg. No Targets	Targets on L MLG Tilt Sws - Flaps 33 deg.	***Flaps 22 Deg. No Targets
P1B-25	LO	**HI	LO
P2B-25	LO	**HI	LO
P1A-51	LO	**HI	LO
P2A-51	LO	**HI	LO

CR R Truck Level

CR NOTE: Throttles must be at idle.

Pin No.	Flaps 22 Deg. No Targets	Targets on R MLG Tilt Sws - Flaps 33 deg.	***Flaps 22 Deg. No Targets
P1A-6	LO	**HI	LO
P2A-6	LO	**HI	LO
P1B-6	LO	**HI	LO
P2B-6	LO	**HI	LO

CR ** Remove targets and logic remain the same.
CR ***If throttle switched are suspected of not resetting MLG tilt logic, advance throttles instead of raising flaps to check reset.

CR DLC/AGSB Breakout Box Logic Tables (Cont)
CR Table 501

CR Throttle Logic

Pin No.	Throttle	Idle	Reverse	Take off
P1A-40	L	LO	HI	
P1A-39	R	LO	HI	
P1A-48	CTR	LO	HI	
P2A-40	L	LO	HI	
P2A-39	R	LO	HI	
P2A-48	CTR	LO	HI	
P1A-45	L	HI		LO
P1A-44	R	HI		LO
P1A-54	CTR	HI		LO
P2A-45	L	HI		LO
P2A-54	CTR	HI		LO
P2A-44	R	HI		LO

R # PFCS MONITORING - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting PFCS Monitoring faults are included in this section of the manual. A PFCS Monitoring malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure.

R Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R 2. Fault Isolation Identification

R Table 101 is a list of the PFCS Monitoring fault isolation diagrams and schematics. Figure 101 and 102 provide component location for PFCS Monitoring troubleshooting.

R A. General

R The fault isolation procedure provides troubleshooting of Faults caused by loss of FCES computer 28 VDC excitation power.

R B. Fault Oriented Fault Isolation

R Figure 103 has four fault isolations procedures geared to a reported malfunction which is a result of a single failure. Figure 103 provides diagnostic steps in a flow chart form which contains complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the action are outside the block. When using the flow chart, it is assumed that systems are in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

R Fault Isolation Diagrams and Schematic List
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Loss of FCES Computer 28 VDC Excitation Power Faults

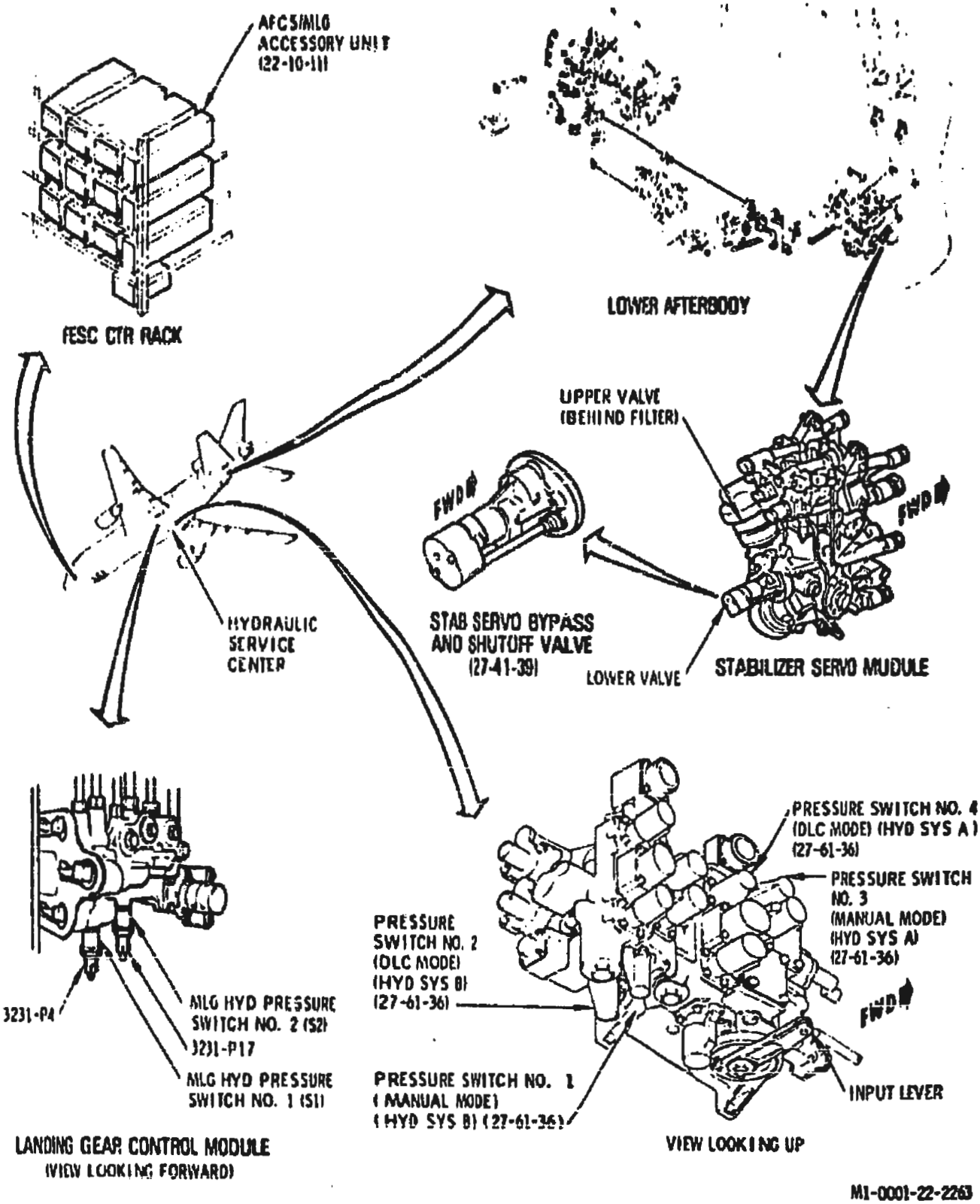
COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCESSORY UNIT – AFCS/MLG	1	FESC, CTR RACK/112AB	22-10-11
SWITCH – DLC SERVO PRESSURE	4	HSC/147AB	27-61-36
SWITCH – MLG HYDRAULIC PRESSURE	2	HSC/147AB	32-31-15
VALVE – STABILIZER SERVO BYPASS AND SHUTOFF, UPPER AND LOWER	2	AFTERBODY, ON STAB SERVO/ 317AB, 317CB	27-41-39

M1-0000-22-2265

R Component Location Index
R Figure 101

EFFECTIVITY: ALL

001B


AFCS/MLG ACCESSORY UNIT (22-10-111)
FESC CTR RACK
LOWER AFTERBODY
UPPER VALVE (BEHIND FILTER)
FWD
FWD
HYDRAULIC SERVICE CENTER
STAB SERVO BYPASS AND SHUTOFF VALVE (27-41-39)
LOWER VALVE
STABILIZER SERVO MODULE
PRESSURE SWITCH NO. 4 (DLC MODE) (HYD SYS A) (27-61-36)
PRESSURE SWITCH NO. 3 (MANUAL MODE) (HYD SYS A) (27-61-36)
PRESSURE SWITCH NO. 2 (DLC MODE) (HYD SYS B) (27-61-36)
3231-P4
MLG HYD PRESSURE SWITCH NO. 2 (S2)
3231-P17
MLG HYD PRESSURE SWITCH NO. 1 (S1)
PRESSURE SWITCH NO. 1 (MANUAL MODE) (HYD SYS B) (27-61-36)
FWD
INPUT LEVER
LANDING GEAR CONTROL MODULE (VIEW LOOKING FORWARD)
VIEW LOOKING UP

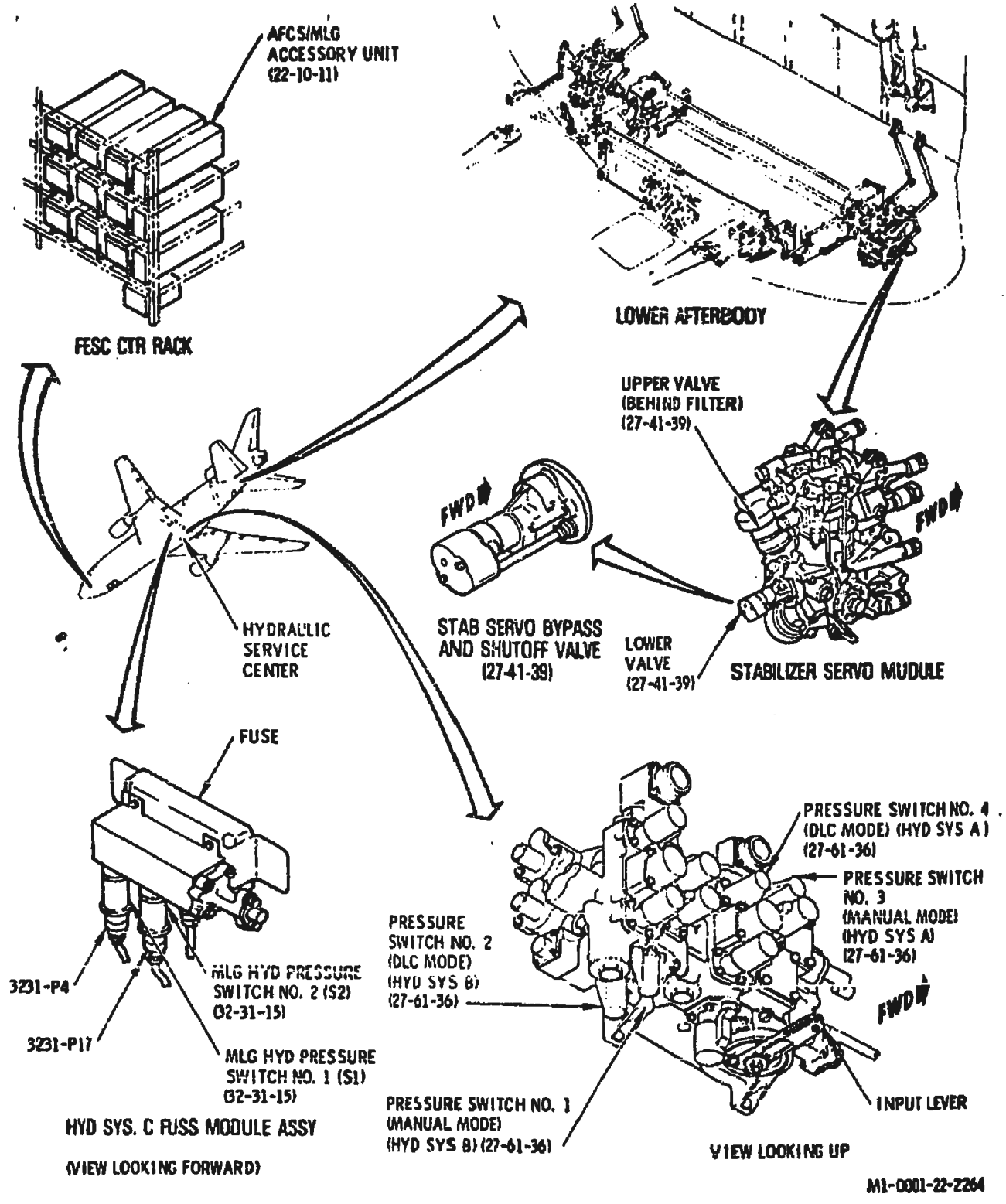
M1-0001-22-2263

R
R

Component Locator Diagram
Figure 102

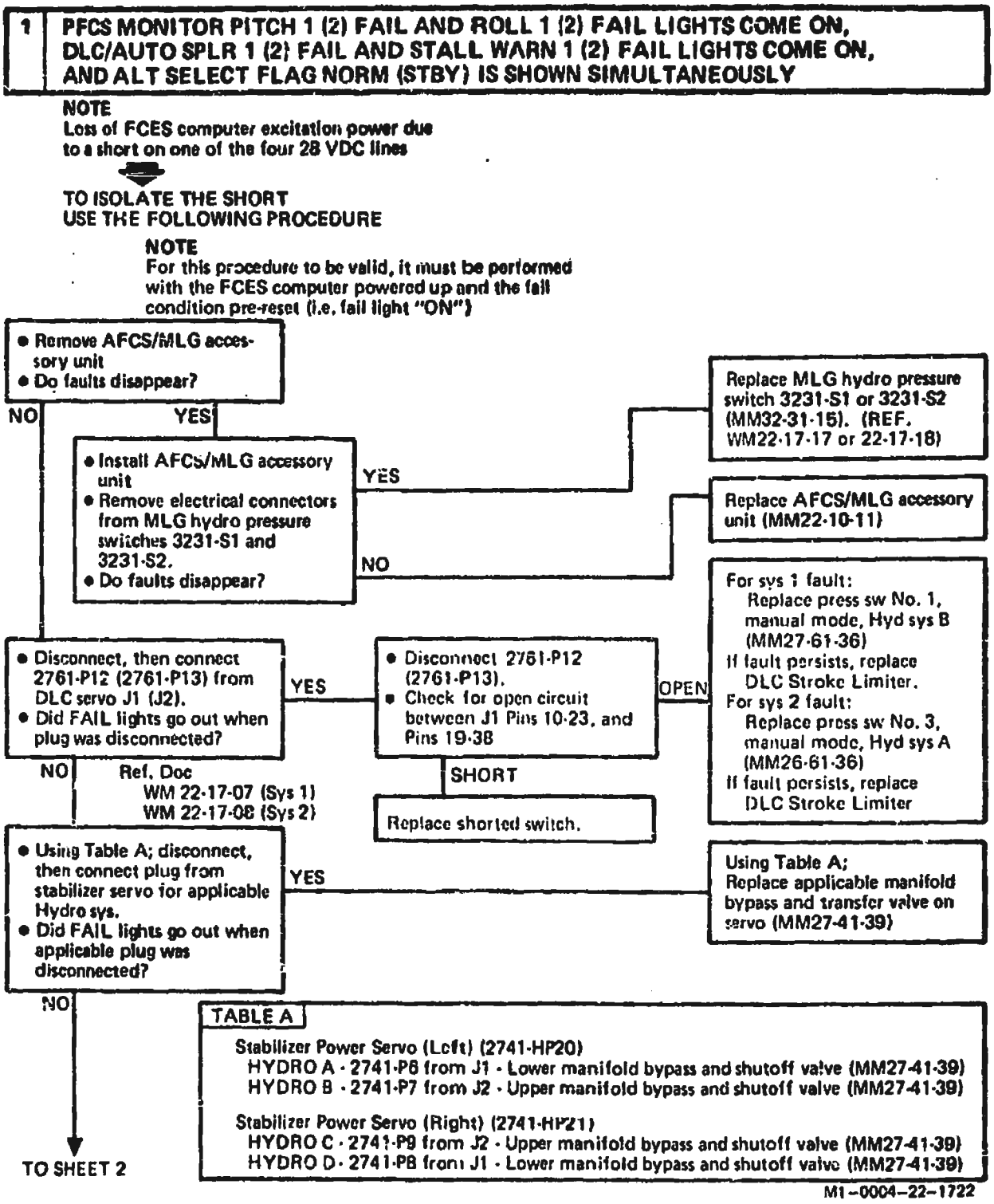
EFFECTIVITY: 001-031 WITHOUT SB29-065

001 B

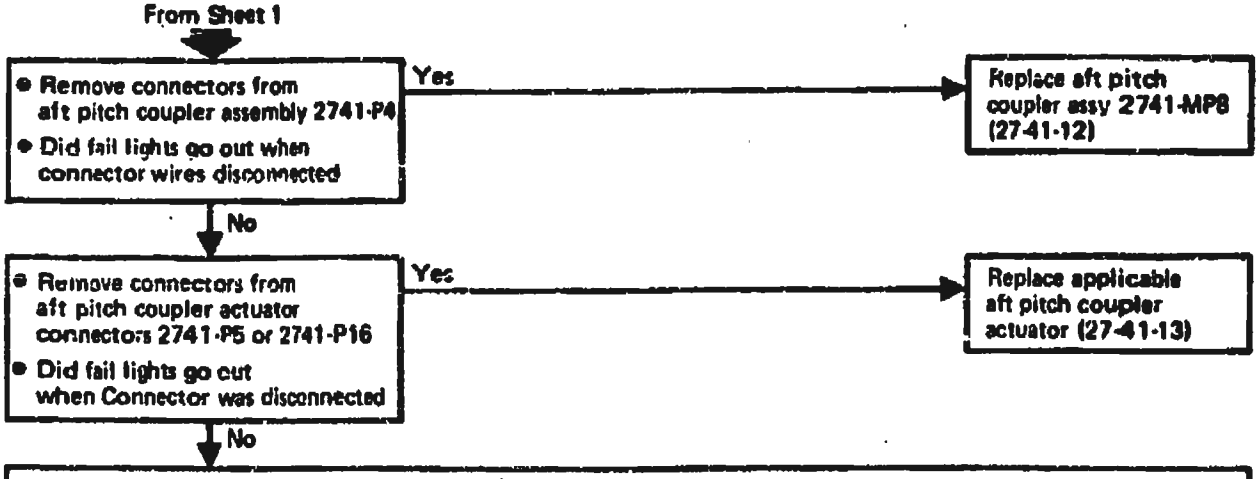


R Component Locator Diagram
R Figure 102

EFFECTIVITY: 001-031 WITH SB29-065, AND 032-999


1 PFCS MONITOR PITCH 1 (2) FAIL AND ROLL 1 (2) FAIL LIGHTS COME ON, DLC/AUTO SPLR 1 (2) FAIL AND STALL WARN 1 (2) FAIL LIGHTS COME ON, AND ALT SELECT FLAG NORM (STBY) IS SHOWN SIMULTANEOUSLY
NOTE
Loss of FCES computer excitation power due to a short on one of the four 28 VDC lines
TO ISOLATE THE SHORT USE THE FOLLOWING PROCEDURE
NOTE
For this procedure to be valid, it must be performed with the FCES computer powered up and the fail condition pre-reset (i.e. fail light "ON")
• Remove AFCS/MLG accessory unit
• Do faults disappear?
NO
YES
• Install AFCS/MLG accessory unit
• Remove electrical connectors from MLG hydro pressure switches 3231-S1 and 3231-S2.
• Do faults disappear?
YES
Replace MLG hydro pressure switch 3231-S1 or 3231-S2 (MM32-31-15). (REF. WM22-17-17 or 22-17-18)
NO
Replace AFCS/MLG accessory unit (MM22-10-11)
• Disconnect, then connect 2761-P12 (2761-P13) from DLC servo J1 (J2).
• Did FAIL lights go out when plug was disconnected?
YES
• Disconnect 2761-P12 (2761-P13).
• Check for open circuit between J1 Pins 10-23, and Pins 19-38
OPEN
For sys 1 fault:
Replace press sw No. 1, manual mode, Hyd sys B (MM27-61-36)
If fault persists, replace DLC Stroke Limiter.
For sys 2 fault:
Replace press sw No. 3, manual mode, Hyd sys A (MM26-61-36)
If fault persists, replace DLC Stroke Limiter
SHORT
Replace shorted switch.
NO
Ref. Doc
WM 22-17-07 (Sys 1)
WM 22-17-08 (Sys 2)
• Using Table A; disconnect, then connect plug from stabilizer servo for applicable Hydro sys.
• Did FAIL lights go out when applicable plug was disconnected?
YES
Using Table A;
Replace applicable manifold bypass and transfer valve on servo (MM27-41-39)
NO
TO SHEET 2
TABLE A
Stabilizer Power Servo (Left) (2741-HP20)
HYDRO A - 2741-P6 from J1 - Lower manifold bypass and shutoff valve (MM27-41-39)
HYDRO B - 2741-P7 from J2 - Upper manifold bypass and shutoff valve (MM27-41-39)
Stabilizer Power Servo (Right) (2741-HP21)
HYDRO C - 2741-P9 from J2 - Upper manifold bypass and shutoff valve (MM27-41-39)
HYDRO D - 2741-P8 from J1 - Lower manifold bypass and shutoff valve (MM27-41-39)
M1-0004-22-1722

R Loss of FCES Computer 28 VDC Excitation Power Faults
R Figure 103 (Sheet 1)


From Sheet 1
• Remove connectors from aft pitch coupler assembly 2741-P4
• Did fail lights go out when connector wires disconnected
Yes
Replace aft pitch coupler assy 2741-MP8 (27-41-12)
No
• Remove connectors from aft pitch coupler actuator connectors 2741-P5 or 2741-P16
• Did fail lights go out when Connector was disconnected
Yes
Replace applicable aft pitch coupler actuator (27-41-13)
No

1. Determine which of the four 28 VDC excitation lines is shorted by checking for a lack of 28 VDC at the following terminal block. Under normal conditions, 28 VDC should be present at each of the terminal blocks.

FCES COMPUTER PIN	TERMINAL BLOCK	
P1A-42	9811-TB951	22/23Y
P1B-42	9811-TB1032	19/20Y
P2A-42	9811-TB1015	12/13Y
P2B-42	9811-TB947	16/17Y

NOTE

The terminal blocks are located forward of the AFCS computers on the left hand side of the aircraft.
Refer to Wiring Diagram 22-17-07 (System No. 1) or 22-17-08 (System No. 2)

2. Once the shortened terminal block is located start to remove the wires on the block one by one until the short disappears. After determining which of the wires has the short, keep chasing the circuit using the wiring diagram until the fault is located.

M1-0000-22-2542

R Loss of FCES Computer 28 VDC Excitation Power Faults
R Figure 103 (Sheet 2)

2 WHEN HYDRO IS APPLIED; PFCS MONITOR PITCH 1 (2) FAIL AND ROLL 1 (2) FAIL LIGHTS COME ON, DLC/AUTO SPLR 1 (2) FAIL AND STALL WARN 1 (2) FAIL LIGHTS COME ON, AND ALT SELECT FLAG NORM (STBY) IS SHOWN SIMULTANEOUSLY FOR THE SAME SYSTEM.

NOTE
Shorted switch on DLC servo or reed switch on stab servo pulling the FCES computer excitation voltage down causing the lights to illuminate.

For FIRM codes followed by -2, use LRU in parenthesis.

- Disconnect, then connect 2761-P12 (2761-P13) from DLC servo J1 (J2).
- Did FAIL lights go out when plug was disconnected?

YES → For sys 1 fault: Replace press sw No. 1, manual mode, Hyd sys B (27-61-36). For sys 2 fault: Replace press sw No. 3, manual mode, Hyd sys A (27-61-36)

NO — Ref. Doc
WDM 22-17-07 (Sys 1)
WDM 22-17-08 (Sys 2)

- Turn off, then turn on Hydro A, B, C and D sys one at a time.
- Did FAIL lights go out when one Hydro sys was turned off?

NO → GO TO FAULT 1.

YES

- Using Table A; disconnect, then connect plug from stabilizer Servo for applicable Hydro sys.
- Did FAIL lights go out when applicable plug was disconnected?

YES → Using Table A; Replace applicable manifold bypass and transfer vlave on servo (27-41-39).

NO → GO TO FAULT 1.

TABLE A

Stabilizer Power Servo (Left) (2741-HP20)
HYDRO A - 2741-P6 from J1 - Lower manifold bypass and shutoff valve (27-41-39)
HYDRO B - 2741-P7 from J2 - Upper manifold bypass and shutoff valve (27-41-39)

Stabilizer Power Servo (Right) (2741-HP21)
HYDRO C - 2741-P9 from J2 - Upper manifold bypass and shutoff valve (27-41-39)
HYDRO D - 2741-P8 from J1 - Lower manifold bypass and shutoff valve (27-41-39)

M1-0001-22-948

R R Loss of FCES Computer 28 VDC Excitation Power Faults
Figure 103 (Sheet 3)

3	WHEN THE AIRCRAFT IS AIRBORNE AND FLAPS ARE POSITIONED GREATER THAN 30 DEGREES; PFCS MONITOR PITCH 1 (2) FAIL AND ROLL 1 (2) FAIL LIGHTS COME ON, DLC/AUTO SPLR 1 (2) FAIL AND STALL WARN 1 (2) FAIL LIGHTS COME ON, AND ALT SELECT FLAG NORM (STBY) IS SHOWN SIMULTANEOUSLY FOR THE SAME SYSTEM.

Shorted switch on DLC servo pulling the FCES computer 28 VDC excitation voltage down causing the lights to illuminate.

For sys 1 fault:
- Replace pressure switch No. 2 (DLC MODE) (HYD SYS B) (27-61-36)

For sys 2 fault:
- Replace pressure switch No. 4 (DLC MODE) (HYD SYS A) (27-61-36)

4	AT TOUCHDOWN; PFCS MONITOR PITCH 1 (2) FAIL AND ROLL 1 (2) FAIL LIGHTS COME ON, DLC/AUTO SPLR 1 (2) FAIL AND STALL WARN 1 (2) FAIL LIGHTS COME ON, AND ALT SELECT FLAG NORM (STBY) IS SHOWN SIMULTANEOUSLY FOR SAME SYSTEMS.

System operation is normal in airborne condition.

Replace AFCS/MGL accessory unit (22-10-11)

M1-0100-22-852

Loss of FCES Computer 28 VDC Excitation Power Faults
Figure 103 (Sheet 4)

STICK SHAKER - REMOVAL AND INSTALLATION

1. Equipment and Materials

   Control Column Lock, BA80, or equivalent

2. Referenced Procedure

R 24-00-00 Electrical Power - Maintenance Practices

3. Removal/Installation

   A. Removal

      (1) In flight station, install control column lock (Ref. Fig. 401).

      (2) Open and tag flight control electrical system STICK SHAKE circuit breaker (B6) on Captains overhead circuit breaker panel, CB1.

      (3) Open access door 112AB to enter forward electronic service center (Ref. 06-40-00).

      (4) Remove stick shaker guard by removing guard mounting screws.

      (5) Disconnect stick shaker electrical connector.

      (6) Remove stick shaker mounting bolts.

   B. Installation

      (1) Ensure control column lock is installed.

      (2) Verify circuit breaker listed for removal is open.

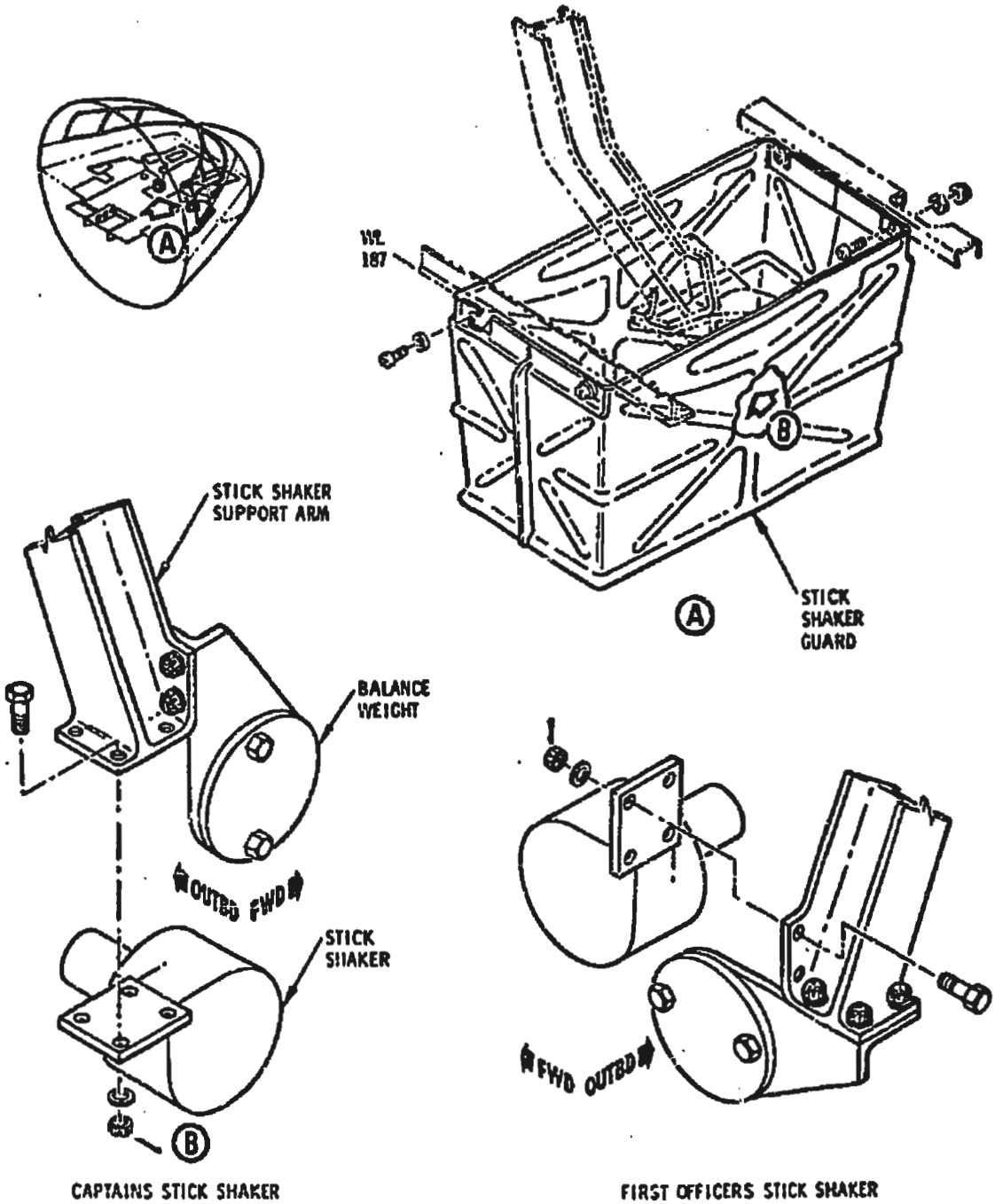
      (3) Install stick shaker with attaching hardware (Ref. Fig. 401).

      (4) Connect electrical connector.

      (5) Install stick shaker guard with mounting hardware.

      (6) Close forward electronic service center access door 112AB.

      (7) Remove control column lock installed in Step 3A(1).

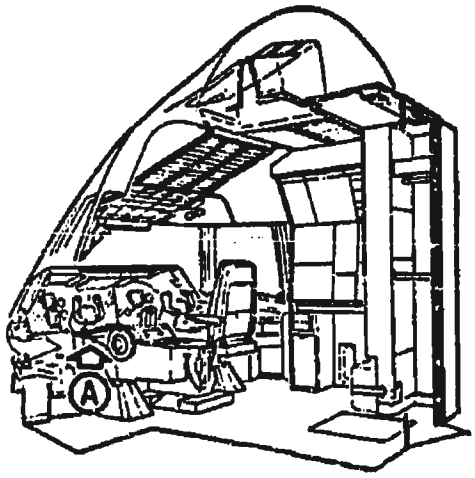


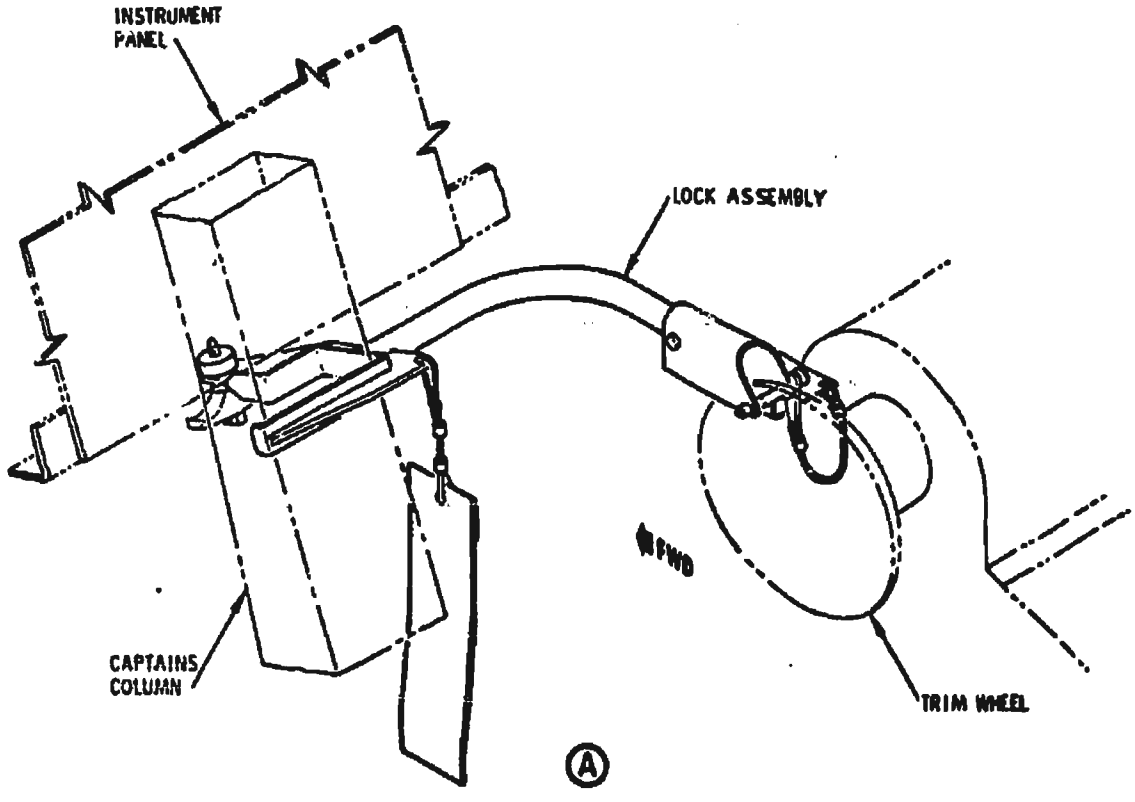
CAPTAINS STICK SHAKER

FIRST OFFICERS STICK SHAKER

HH 7882
M1-0100-27-182

Stick Shaker - Removal and Installation
Figure 401 (Sheet 1)





HH 6854
M1-0100-27-103

Stick Shaker - Removal and Installation
Figure 401 (Sheet 2)

(8) Remove tag and close circuit breaker opened in Step 3A(2).

(9) Remove placards installed in Step 3.

(10) Perform Stick Shaker Check.

C. Stick Shaker Check

(1) Turn on electrical power (Ref. 24-00-00).

R (2) On FCES panel, depress STALL WARN 2 switchlight to OFF,
R and STALL WARN 1 switchlight to on (no light). Depress
R DLC/AUTO SPLR 1 and 2 switchlights to OFF.

(3) On FCES panel, depress and hold TEST switch. Both control columns vibrate.

(4) Release TEST switch. Vibration of control columns stop.

(5) Depress STALL WARN 1 switchlight to OFF, and STALL WARN 2 switchlight to on.

(6) Depress and hold TEST switch. Both control columns vibrate.

(7) Release TEST switch. Vibration of control columns stop.

(8) Depress STALL WARN 1 switchlight to on.

(9) Turn off electrical power.

TRIM AUGMENTATION SYSTEM - DESCRIPTION AND OPERATION

1. General

The Trim Augmentation System is installed in the aircraft to provide stabilization in the pitch axis. It consists of three subsystems; the Pitch Trim System, the Mach Trim System, and the Mach Feel System. The Pitch Trim System is the only system described in this section, as the Mach Trim and Feel Systems are
R described in Section 22-21-00. Figure 1 shows the components of the pitch trim system and their location.

Stabilization in the pitch axis is required to maintain longitudinal stability, which can be disrupted by such factors as air turbulence, shifting personnel, etc. The pitch trim system can be operated manually by means of the manual electrical pitch trim wheel, or automatically by means of the auto trim transducer when the autopilot is engaged.

The Pitch Trim System consists of the following major components

Trim Augmentation Computer

Electric Trim Motor

Manual Electrical Pitch Trim Switch on Control Wheel

FCES Control Panel

Auto Trim Transducer

Surface Position Indicator

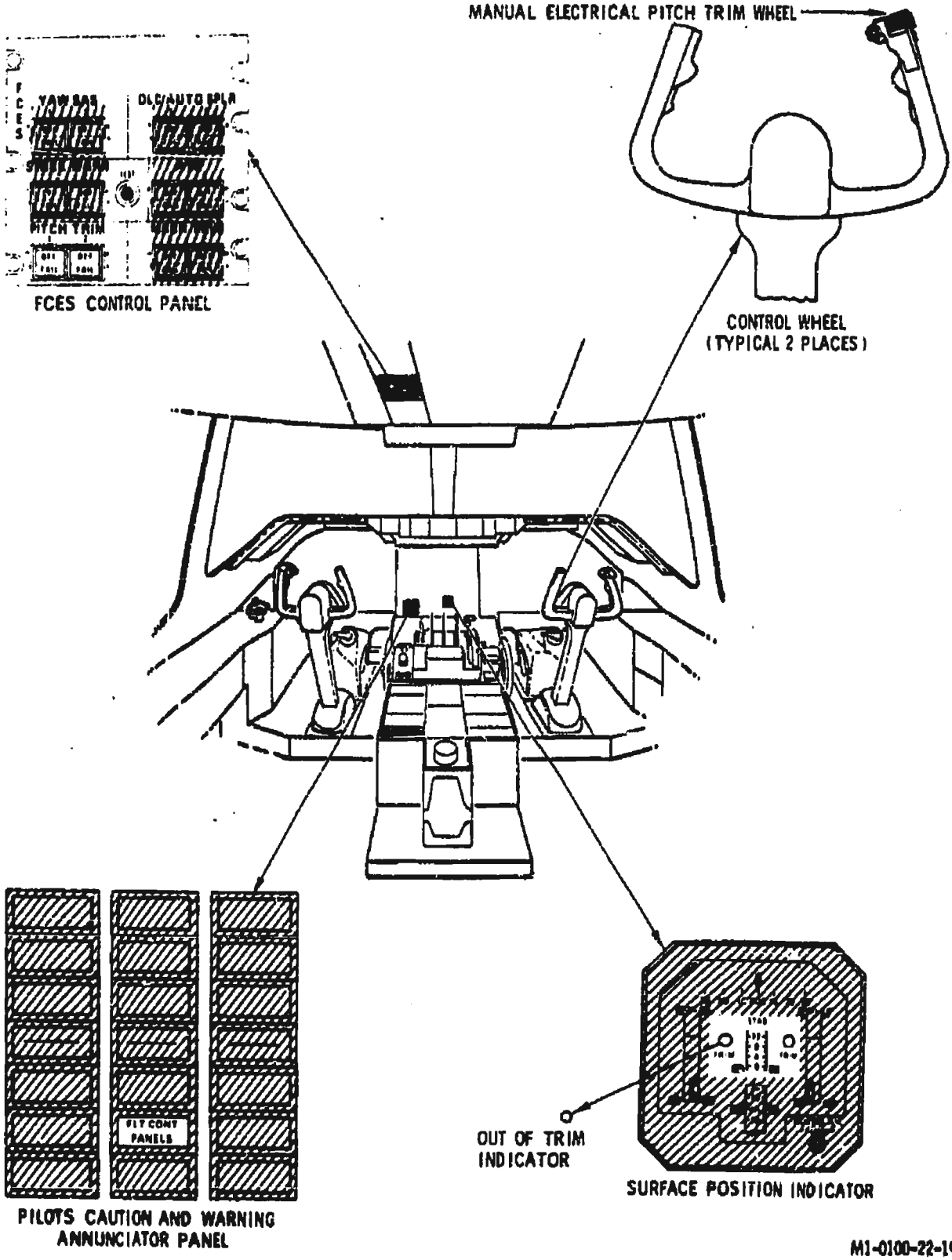
A block diagram of the Pitch Trim System is shown in Figure 2.

2. Pitch Trim System

A. General

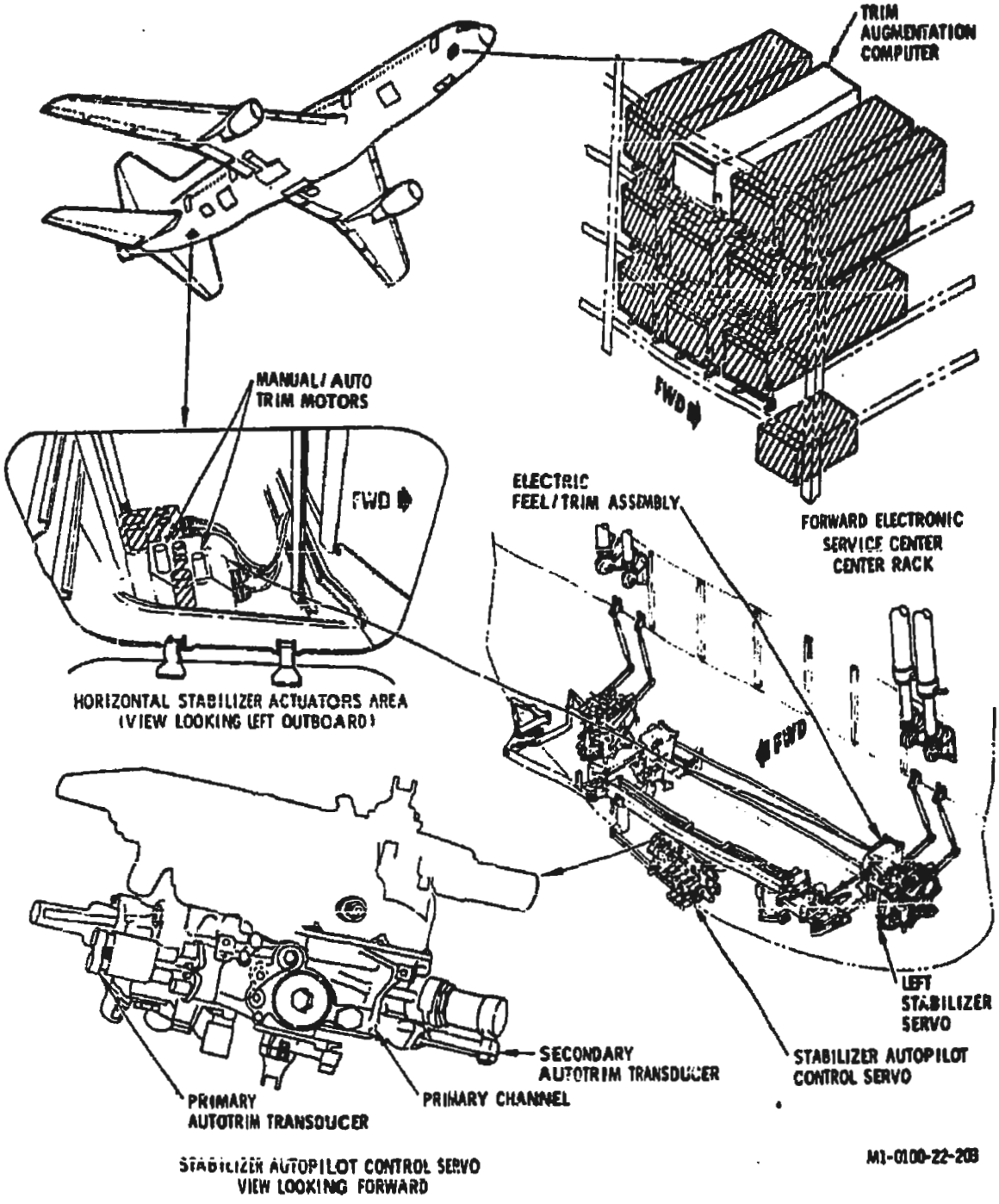
The Pitch Trim System controls the stabilizer of the aircraft, through an electro mechanical system. Control signals generated by trim wheels on the control wheels or by computers are used by the electrical/electronic circuits to drive electrical motors. These Pitch Trim Motors in turn drive mechanical gears and linkages which control a servo system that operates the horizontal stabilizer.

B. Operation



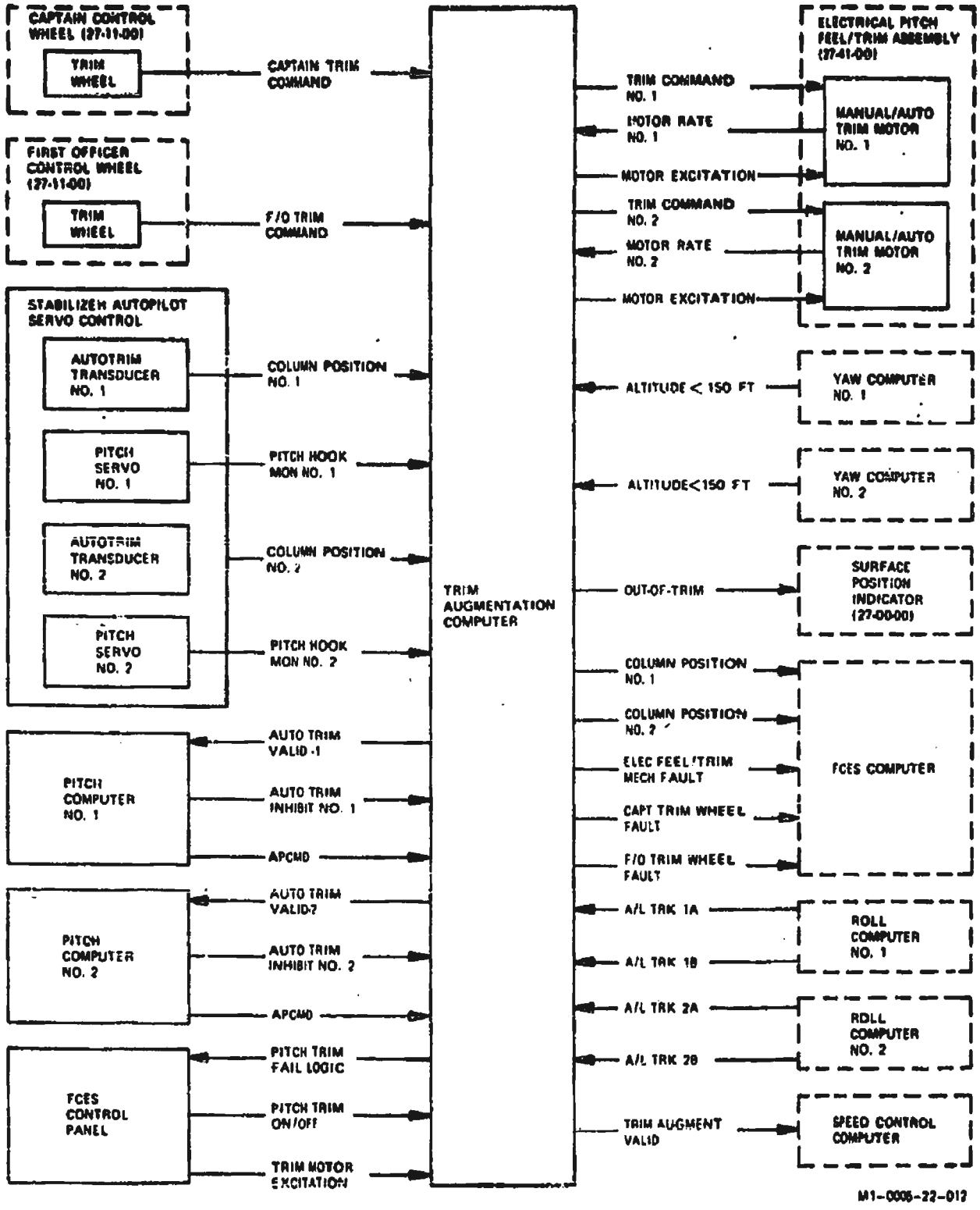
R
R

Pitch Trim System Equipment and Location
Figure 1 (Sheet 1)



R Pitch Trim System Equipment and Location
R Figure 1 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



R R Pitch Trim System Block Diagram
Figure 2

EFFECTIVITY: ALL

001B

The functional signal flow of the Pitch Trim System is shown in Figure 3.

(1) Power Application

The pitch trim system receives power from the aircraft electrical system buses through the pilots overhead panel circuit breakers. The circuit breakers are located in the areas designated AVIONICS FLIGHT CONTROL SYSTEM on the circuit breaker panel.

R (a) AC Power

The TRIM AGMT AC (NO. 1 SYSTEM) (CB1-A7) circuit breaker on the 115V, 400 Hz, Phase A essential bus distributes power to channel 1 of the trim augmentation computer and to the FCES control panel. The TRIM AGMT AC (NO. 2 SYSTEM) (CB1-A25) circuit breaker on the 115V, 400 Hz, Phase B extention bus supplies power to channel 2 of the computer and to the FCES control panel.

The power to each computer channel is processed by the computer channel power supply to produce the required operating voltages for the channel. The voltages to the FCES control panel are switched and applied to the manual/auto trim motors through the trim augmentation computer.

R (b) DC Power

The TRIM AGMT DC (NO. 1 SYSTEM) (CB1-A8) circuit breaker on the 28V dc essential bus distributes power to channel 1 of the trim augmentation computer. The TRIM AGMT DC (NO. 2 SYSTEM) (CB1-A26) circuit breaker on the 28V dc No. 2 bus provides power to channel 2 of the computer.

The power to each computer channel is applied to the fault isolation monitor and also through the computer to the center tap of the manual/auto trim motor control winding.

(2) Manual/Automatic Pitch Trim Engagement

The two manual/automatic pitch trim channels are independently and simultaneously engageable through the PITCH TRIM switchlights on the FCES control panel. The

switchlights are normally depressed (latched in) when aircraft power is applied.

The 28V dc produced by the trim augmentation computer power supplies are applied to the respective switchlights. The engaged switchlights return channel-on signals to the engage logic circuits of the computer pitch trim channels. The switchlights apply 115V ac 400 Hz motor excitation to the manual/auto trim motors through the computer.

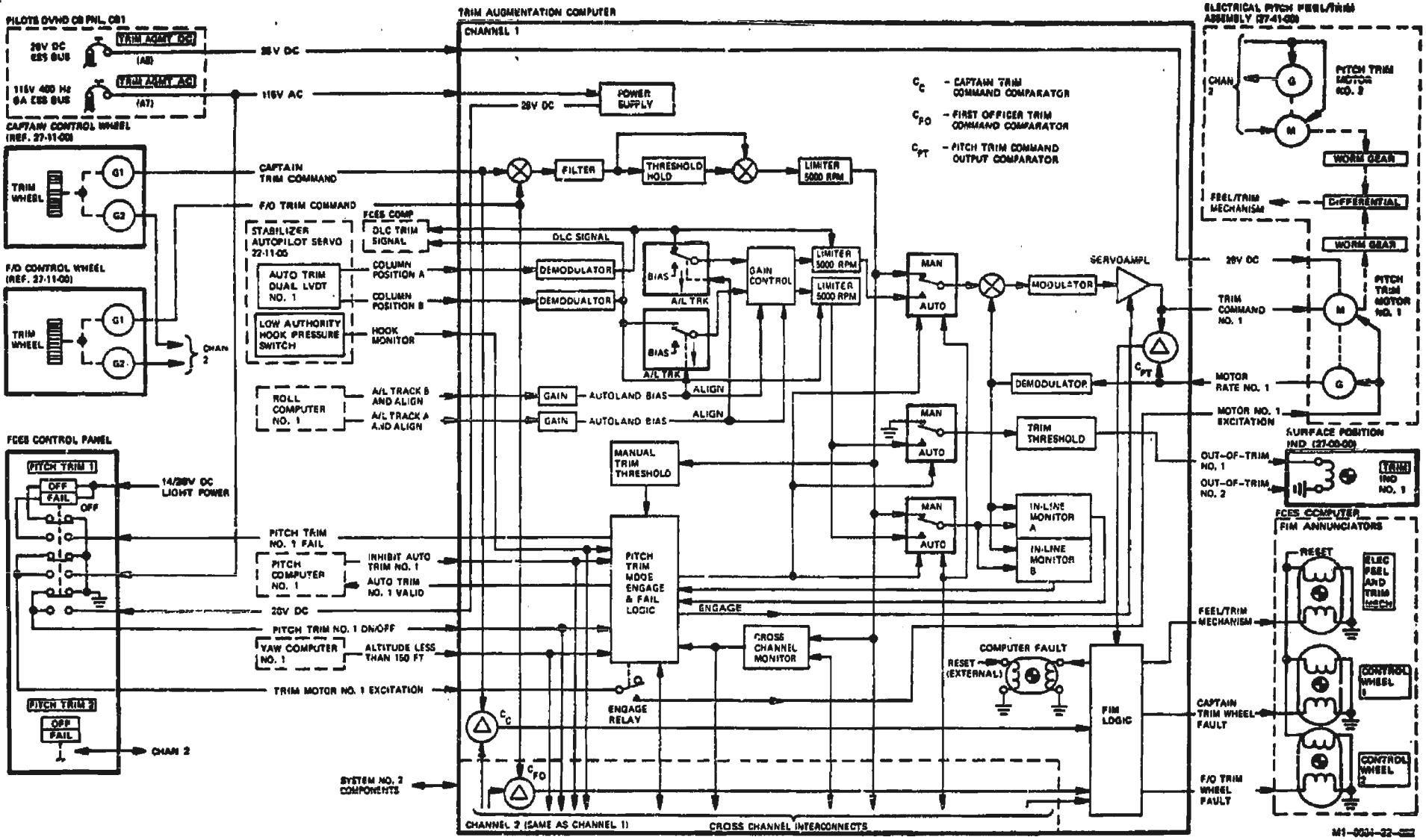
One channel can be selected for operation by manually disengaging the other channel. To disengage a channel, the associated PITCH TRIM switchlight is released (out), which removes the channel-on signal from the channel and at the same time removes power from the associated trim motor. Upon disengagement, the switchlight obtains a ground through its switch contacts to light the OFF legend. Reengagement is performed by depressing the switchlight again.

(3) Manual Electrical Pitch Trim

Manual operation of the pitch trim system is accomplished by manually rotating a knurled knob on the Captains and First Officers Control wheels in the cockpit. Each knurled knob or pitch trim thumbwheel drives two rate generators which produce a dc voltage that is proportional to the rate of the trim wheel rotation. The pitch trim command output signal voltage from one rate generator on either trim wheel is applied to pitch trim channel 1 in the trim augmentation computer. The output of the second rate generator on either trim wheel is applied to pitch trim channel 2.

The pitch trim command signal is shaped and limited by the computer and then applied to the servo amplifier circuits to drive the associated pitch trim motor in the electrical trim and feel assembly. The output shaft of the two pitch trim motors (one for each channel) are coupled through gears to differentials, the resultant output of which drives the pitch feel/trim mechanisms. The mechanisms, in turn, drive the stabilizer and control columns through the flight control linkage to a position proportional to the angular displacement of the manual trim wheel.

In addition to driving the differentials, the pitch trim motor drives a rate generator (one for each channel) whose output signal is proportional to the speed of the pitch trim motor. This signal is fed back and summed into the pitch trim input circuit. This



R Pitch Trim System Functional Block Diagram
R Figure 3

EFFECTIVITY: ALL

feedback signal provides damping of the pitch trim command signal and prevents pitch trim overshoot.

(4) Automatic Pitch Trim

The automatic pitch trim function is engaged when the autopilot is engaged. Any disturbance in the pitch attitude of the aircraft is sensed by vertical gyros. An output signal from the vertical gyros proportional to the attitude disturbance is fed to the autopilot pitch system. Output signals from the autopilot pitch system are routed to the stabilizer autopilot servo unit which in turn operates the horizontal stabilizer and control columns.

Two dual auto trim LVDT (Linear, Variable, Differential Transformer) units are operated by the stabilizer autopilot servo package. The output of the LVDT units are column trim position signals fed to the pitch trim channels in the trim augmentation computer. These trim command signals are shaped and limited in the computer and fed to the servo amplifiers, the output of which drive the pitch trim motors in the electrical trim and feel assembly. The output shaft of the pitch trim motor is coupled through gears to differentials, the resultant output of which drives the pitch feel/trim mechanisms. The mechanisms, in turn, ultimately provide fine adjustments to the stabilizer and adjusts the pitch feel/trim feel spring as required. In addition to driving the differential, the pitch trim motor drives a rate generator whose output signal is proportional to the speed of the pitch trim motor. This signal is again used as a feedback signal to dampen the pitch trim motor and prevent overshoot.

(5) Pitch Trim In-Line Monitors

An in-line monitor is contained in each channel of the computer to continuously monitor each pitch trim channel. The trim command signal and trim motor rate feedback signal inputs, which represent the overall channel operation, are monitored. When the monitor detects a failure, the related engage logic circuit automatically inhibits the trim command output signal. At the same time, the engage logic circuit provides a fail logic signal to the FCES control panel, which causes the FAIL legend on the associated PITCH TRIM switchlight to come on.

(6) Pitch Trim Cross-Channel Monitors

A cross-channel monitor is included in the computer to compare the two trim command signal inputs to the channel servo loops during the manual electrical trim function. The two signals must be compatible within a preset threshold for both channels to be operational. If the monitor detects a deviation above the preset threshold, the related engage logic circuits automatically inhibit both trim command output signals. At the same time, the logic circuits provide a fail logic signal to both PITCH TRIM switchlights on the FCES control panel to cause the FAIL legend to come on.

(7) Fault Isolation Monitor

A fault isolation monitor (FIM) is included in each channel of the trim augmentation computer for ground maintenance purposes. The FIM can isolate a failure to a certain input, the computer, or the output of the trim channel. A computer failure isolated by either FIM is indicated by the FIM annunciator on the computer front panel. In addition to computer failures, the FIMS isolate failures to the control wheel inputs or the electrical feel/trim mechanisms. The monitoring FIM sends an annunciation logic signal (ground) to set the associated FIM annunciator provided on the FCES computer front panel. The annunciators on the FCES computer applicable for the pitch trim function are CONTROL WHEEL 1, CONTROL WHEEL 2, and ELEC FEEL & TRIM MECH. For detailed description, see 22-09-00.

R

3. Trim Augmentation Computer

The Trim Augmentation Computer is located in the forward electronic service center, rack (Ref. Fig. 1). Aircraft ac and dc power are fed to the computer, which processes this power to energize various components of the system such as computer power supplies, control circuits, motor circuits, monitor circuits, and fault logic circuits. The computer houses the pitch trim, mach feel, and mach trim electronic circuits. The mach feel and trim portions are discussed in 22-21-00. The pitch trim portion of the computer monitors the manual pitch trim command circuits of the trim wheels, and the automatic pitch trim command circuits of the pitch servos, by which it drives the pitch trim motors. In addition, the computer utilizes the monitor and fault logic circuits to compare the operation of the two pitch trim channels. Should a failure occur, these circuits select the active channel, and indicate the failure on the FCES computer, the trim augmentation computer or the FCES control panel.

4. Electric Trim Motor

There are two electric trim motors located on the electrical pitch feel/trim assembly in the afterbody section. The operation of the motor is the same as the Mach trim motor described in 22-21-00.

5. FCES Control Panel

The FCES control panel is located on the pilots overhead control panel (Ref. Fig. 1). The FCES control panel contains PITCH TRIM 1 and 2 switchlights to monitor and control the PITCH TRIM channels. The switchlights have FAIL-OFF legends. If failure is detected in a trim augmentation system channel the associated FAIL message comes on. When the applicable switchlight is depressed, the FAIL message goes out and the OFF message comes on. The OFF message indicates that the failed channel is turned off. The switchlights also provide selective engagement and disengagement of the pitch trim system channels. For a detailed description of the FCES control panel, see 22-10-00.

6. Manual Electrical Pitch Trim Wheel

R There are two manual electrical pitch trim wheels. One is located on the Captains control wheel, the other on the First Officers, (Ref. Fig. 1). The trim wheel is a thumb operated
R serrated cylinder. The rotation of the trim wheel drives a dual
R DC rate generator which generates a signal proportional to the
R rate of rotation of the trim wheel. TheFirst Officers DC trim
R rate generator produces outputs of opposite polarity than those
R produced by the Captains trim rate generator. The rate
R generator signal is fed into the manual pitch trim circuit of
R the trim augmentation computer where it compensates for the
R polarity difference and is processed to drive the trim motors.

7. Autotrim Transducer

Two autotrim transducers (two dual LVDT) are installed in the stabilizer autopilot control servo. The transducer senses the relative position of the output and trim input arms. An electrical signal equivalent to the position difference sensed is transmitted to the associated channels of the pitch trim system. The system processes the signal for use in the automatic trim and direct lift control functions. The transducers receive the 26V ac excitation voltage from the system trim augmentation computer.

8. Surface Position Indicator

The surface position indicator (SPI) is located on the pilots center instrument panel. The SPI has two indicators that display autotrim operation. The left indicator displays PITCH TRIM 1 autotrim operation, and the right indicator displays PITCH TRIM 2 autotrim operation. Normally, both trim indicators are black. When autotrim signals are driving the trim motors on the electrical pitch feel/trim assembly, the indicators are momentarily yellow. A continuous yellow indication shows that a channel of the autotrim system is malfunctioning.

9. Pitch Trim System Interface

The pitch trim system interfaces with the following equipment

22-11-00 Stabilizer Autopilot Control Servo

22-11-00 Pitch Computers

22-13-00 Roll Computers

22-15-00 Yaw Computers

22-31-00 Speed Control Computers

R 27-41-00 Electrical Pitch Feel Trim Assembly

22-17-00 FCES Computer

A. Stabilizer Autopilot Control Servo

The stabilizer autopilot control servo is located in the lower section of the afterbody, between the left and right stabilizer servos. The primary and secondary autotrim transducers which are located on the servo, provide each pitch trim system with column position for autotrim. The hook monitor low authority hook pressure switches provide each pitch trim system a signal whenever an autopilot is engaged. When either pitch hook is engaged, the pitch trim system switches to auto mode. This then disconnects trim wheel inputs and selects the column position signals for the command signal. For a detailed description of the stabilizer autopilot control servo, see 22-11-00.

B. FCES Computer

The FCES Computer is located on the forward electronics service center, center rack. The pitch trim system provides the FCES computer with column trim position to control DLC. The pitch trim system also provides ELEC FEEL & TRIM MECH,

CONTROL WHEEL 1, and CONTROL WHEEL 2 fault signals that are displayed on the front of the FCES computer.

C. Electrical Pitch Feel Trim Assembly (Left)

The electrical pitch feel/trim assembly is located in the lower afterbody section, and is mounted just inboard of the left stabilizer servo module. The two electric trim motors are mounted on the assembly (Ref. Fig. 1). The assembly receives and processes pitch trim electrical signals as well as Mach feel and trim signals. For a detailed description of the assembly, see 27-41-00.

D. Pitch Computers

Two pitch computers are located on the forward electronic service center, center rack. Each pitch computer provides an autopilot command (APCMD) signal and an INHIBIT AUTO TRIM signal to each pitch trim system channel. Each pitch trim system channel provides an AUTO TRIM VALID signal to each pitch computer. For a detailed description of the pitch computer, see 22-11-00.

E. Roll Computers

Two roll computers are located on the forward electronic service center, center rack. Each roll computer provides an AUTOLAND track (ALTRK) signal to each pitch trim system channel. For a detailed description of the roll computer, see 22-13-00.

F. Yaw Computer

Two yaw computers are located on the forward electronic service center, center rack. Each yaw computer provides a less than 150-foot signal to each pitch trim system channel. For a detailed description of the yaw computer, see 22-15-00.

G. Speed Control Computer

The speed control computer is located on the forward electronic service center, center rack. The trim augmentation computer provides the speed control computer with a trim augmentation power valid (TA PWR VALID) signal. For a detailed description of the speed control computer, see 22-31-00.

TRIM AUGMENTATION SYSTEM - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting pitch trim system faults are included in this section of the manual. A pitch trim system malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use system oriented fault isolation (Ref. Paragraph 4B).

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

Pitch trim fault isolation contains two levels of trouble shooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 4A) trouble shoots a specific manual or automatic pitch trim problem. System oriented fault isolation (Ref. Paragraph 4B) tests and trouble shoots the pitch trim system.

2. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices

3. Equipment and Materials

Breakout Cable Assembly for Trim Augmentation Computer, G/ITEL No. 22-00-19 (See Figure 108, 22-12-37). (One Req.)

R Breakout Cable Assembly for Pitch Computer, G/ITEL No. 22-00-20
R (see 22-12-37, Figure 509 (Two Req.).

4. Fault_Isolation_Identification

Table 101 is a list of the pitch trim system fault isolation diagrams and schematics. Figures 101 and 102 provide component location for the pitch trim system troubleshooting.

Fault Isolation Diagrams and Schematics List
Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Pitch Trim Fault Matrix
104	Automatic Pitch Trim Fault Isolation
105	Manual Override of Automatic Pitch Trim Fault Isolation
106	Manual Pitch Trim Fault Isolation
SCHEM 1	Trim Augmentation Computer Power Distribution Schematic
SCHEM 2	Pitch Trim Signal Flow Schematic
SCHEM 3	Pitch Trim Engage/Fail Logic Schematic
SCHEM 4	Pitch Trim Switching Logic Schematic
SCHEM 5	Trim Augmentation Computer FIM

A. Fault Oriented Fault Isolation

Fault oriented fault isolation is geared to a reported malfunction which is a result of a single failure. Figure 103 identifies a fault within the manual or auto pitch trim system by a specific fault number. It also identifies and R locates the Line Replaceable Units (LRU) which can cause the problem. For faults not listed in Figure 103, perform System Oriented Fault Isolation in Paragraph 4A to isolate problem.

Figures 104, 105, and 106 provide diagnostic steps to further isolate the fault. The diagnostic steps are in a flow-chart form which contains complete fault isolation procedures for each fault. Action instructions are contained within the blocks of the flow chart while the monitored results of the actions are outside the blocks. When using the flow charts, it is assumed that systems are

in the normal operational mode, all relevant circuit breakers have been checked, and all applicable aircraft operational procedures have been accomplished.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ASSEMBLY - PITCH FEEL AND TRIM ELECTRICAL (LEFT)	1	AFTERBODY/3178B	27-41-16
COMPUTER - PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER - TRIM AUGMENTATION	1	FESC, CTR RACK/112AB	22-18-01
GENERATOR ELECTRICAL PITCH TRIM	2	FLT STA, CONT WHL	22-10-23
INDICATOR SURFACE POSITION	1	FLT STA, PILOTS INSTR PNL	27-00-01
MOTOR - PITCH ELECTRIC TRIM	2	AFTERBODY, ON PITCH TRIM AND FEEL ASSY/ 3178B	22-18-10
SERVO STABILIZER AUTOPILOT CONTROL	1	AFTERBODY/316DB	22-11-05
SWITCH - AP A(B) HYD SYS B(A) LOW AUTHORITY HOOK PRESSURE	2	AFTERBODY, ON STAB AP CONT SERVO/316DB	22-11-09
WHEEL - CONTROL	2	FLT STA	27-11-01

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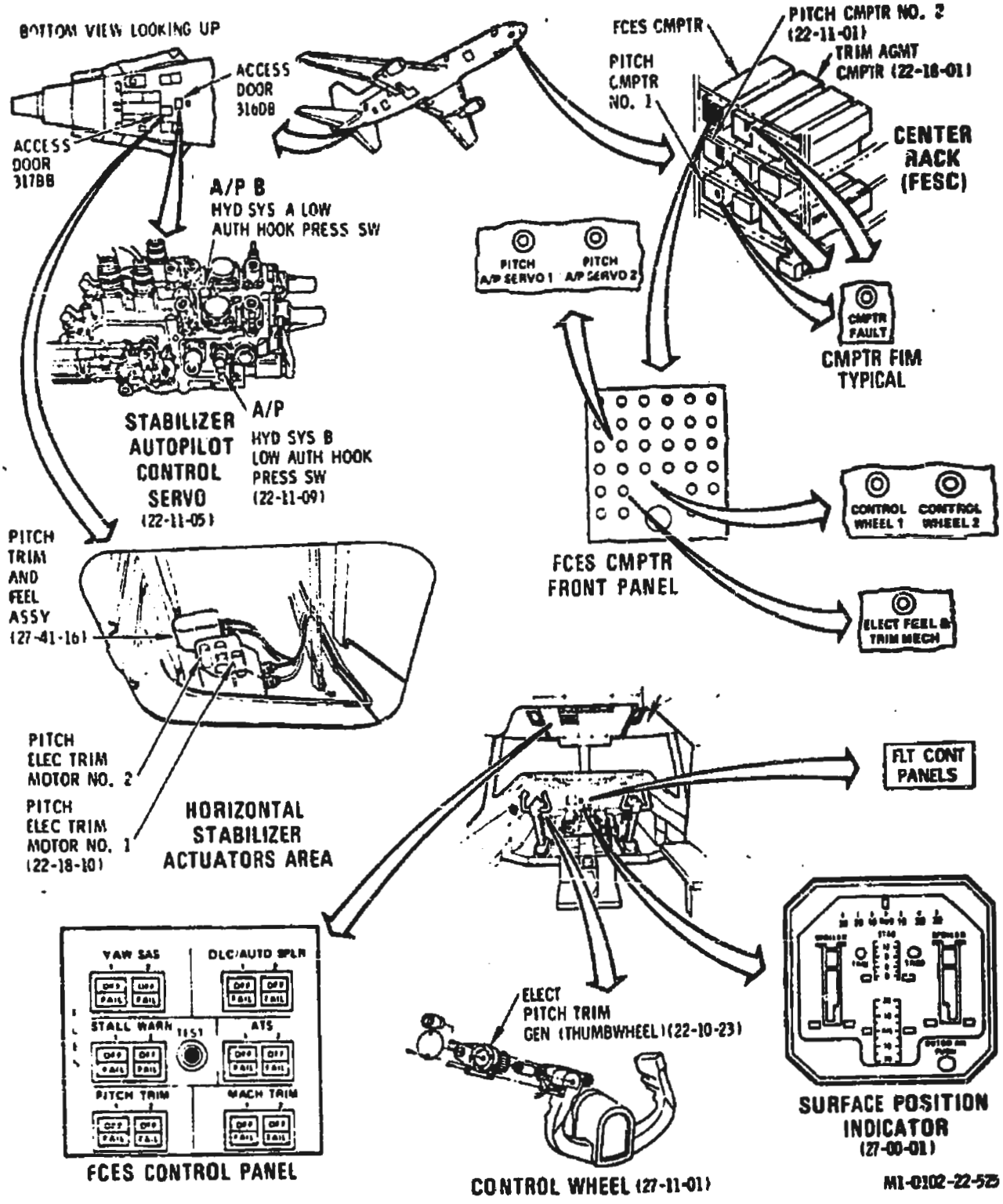
R
R

Component Location Index
Figure 101

EFFECTIVITY: ALL

001B



R Component Locator Diagram
R Figure 102

← FAULTS →			← FIM →								← NO FIM →		
			Troubleshooting Faulty LRU										
			Check FIM on LRU or on Front Panel of FCES Cmptr								Continuity Check or Replace		
No.	Problem		TAC	GEN	CW	PT MOT	PF & TA	PC	AP SERVO	PRESS SW	FCES CP	SPI	HF JAM
"AUTO PITCH TRIM" FAULTS (Ref. Fig 104)													
1	PITCH TRIM 1 FAIL light on		X			1	X				X		
2	PITCH TRIM 1, MACH TRIM 1, MACH FEEL 1 FAIL lights on		X										
3	PITCH TRIM 1, DLC/AUTO SPLR 1 FAIL lights on		X						X				
4	PITCH TRIM 1, DLC/AUTO SPLR 1 FAIL lights on. Left TRIM ind on SPI always black		X						X				
5	PITCH TRIM 1 and both MACH TRIM FAIL lights on						X						
6	PITCH TRIM 2 FAIL light on		X			2	X				X		
7	PITCH TRIM 2, MACH TRIM 2, MACH FEEL 2 FAIL lights on		X										
8	PITCH TRIM 2, DLC/AUTO SPLR 2 FAIL lights on		X						X				
9	PITCH TRIM 2, DLC/AUTO SPLR 2 FAIL lights on. Right TRIM ind on SPI always black		X						X				
10	Both PITCH TRIM FAIL lights on		X										
11	Both PITCH TRIM and both MACH TRIM FAIL lights on						X						
12	Left TRIM ind on SPI always black		X									X	
13	Left TRIM ind on SPI always yellow		X									X	
14	Right TRIM ind on SPI always black		X									X	
15	Right TRIM ind on SPI always yellow		X									X	
"MANUAL OVERRIDE OF AUTO PITCH TRIM" (Ref. Fig. 105)													
21	Without CW force, manual trim wheel follows thumbwheel. (AP A in CWS or CMD with no modes engaged, and A/C airborne		X		1/2			1/2					
22	Same as 21 with A/P LIMIT message		X							A			
23	Without CW force, manual trim wheel follows thumbwheel. (AP B in CWS or CMD with no modes engaged, and A/C airborne		X		1/2			1/2					
24	Same as 23 with A/P LIMIT message		X							B			

(Cont.)

M1-0002-22-528

R
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Pitch Trim Fault Matrix
Figure 103 (Sheet 1)

EFFECTIVITY: ALL

0018

← FAULTS →		← FIM →								← NO FIM →		
		Troubleshooting Faulty LRU										
		Check FIM on LRU or on Front Panel of FCES Cmptr								Continuity Check or Replace		
No.	Problem	TAC	GEN	CW	PT MOT	PF & TA	PC	AP SERVO	PRESS SW	FCES CP	SPI	HF, JAM
"MANUAL PITCH TRIM" FAULTS (Ref. Fig. 106)												
31	PITCH TRIM 1 FAIL light on	X								X		
32	PITCH TRIM 1, MACH TRIM 1, MACH FEEL 1 FAIL lights on	X										
33	PITCH TRIM 1 FAIL light comes on when rotating thumbwheel	X			1	X				X		
34	PITCH TRIM 1 FAIL light comes on when rotating thumbwheel. Both MACH TRIM FAIL lights on					X						
35	PITCH TRIM 2 FAIL light on	X								X		
36	PITCH TRIM 2, MACH TRIM 2, MACH FEEL 2 FAIL lights on	X										
37	PITCH TRIM 2 FAIL lights come on when rotating thumbwheel	X			2	X				X		
38	Both PITCH TRIM FAIL lights on	X										
39	Both PITCH TRIM FAIL lights come on when rotating thumbwheel	X	1/2	1/2								
40	When rotating thumbwheel, manual trim wheel "does not" follow. PITCH TRIM FAIL lights "do not" come on. (1 = AP A ON, 2 = AP B ON, 3 = AP OFF)	X	1/2	1/2			1/2					X
41	Both PITCH TRIM FAIL lights come on when rotating thumbwheel. Both MACH TRIM FAIL lights on					X						
42	When rotating thumbwheel, manual trim wheel does not rotate smoothly, or it binds up, or jams. PITCH TRIM FAIL lights "do not" come on											X

M1-0101-22-527

R
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Pitch Trim Fault Matrix
Figure 103 (Sheet 2)

EFFECTIVITY: ALL

0018

Abbreviations		Remove and Install Ref.	
		Chapt	Page
AP SERVO	Stabilizer AP Control Servo	22-11-05	401
CW	Control Wheel	27-11-01	401
FCES CP	FCES Control Panel	22-10-07	401
GEN	Electrical Pitch Trim Generator	22-10-23	401
HF & JAM	High friction or jam in pitch trim sys (Ref. 27-42-00)		
PC	Pitch Computer	22-11-01	401
PF & TA	Pitch Feel and Trim Assy	27-41-18	401
PRESS SW	AP LOW AUTH HOOK PRESS SW.	22-11-09	401
PT MOT	Pitch Electric Trim Motor	22-18-10	401
SPI	Surface Position Ind	27-00-31	401
TAC	Trim Augmentation Computer	22-18-01	401
X	One LRU Common to Both Sys		
1	No. 1 LRU Associated with Sys 1 Problem		
2	No. 2 LRU Associated with Sys 2 Problem		

HOW TO USE

1. Find flight squawk in FAULTS column
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 or 105 or 106

NOTE

1. Auto Pitch Trim = Aircraft in air, and either AP turned on. (Autopilot stab servo trims aircraft automatically.)
2. Manual Override of Auto Pitch Trim = Aircraft in air, either AP in CWS or CMD with no modes engaged, and a pitch force on control wheel greater than 4 pounds (Thumbwheel trims aircraft.)
3. Manual Pitch Trim = AP turned off, or AP turned on but aircraft on ground (Thumbwheel trims aircraft.)

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R
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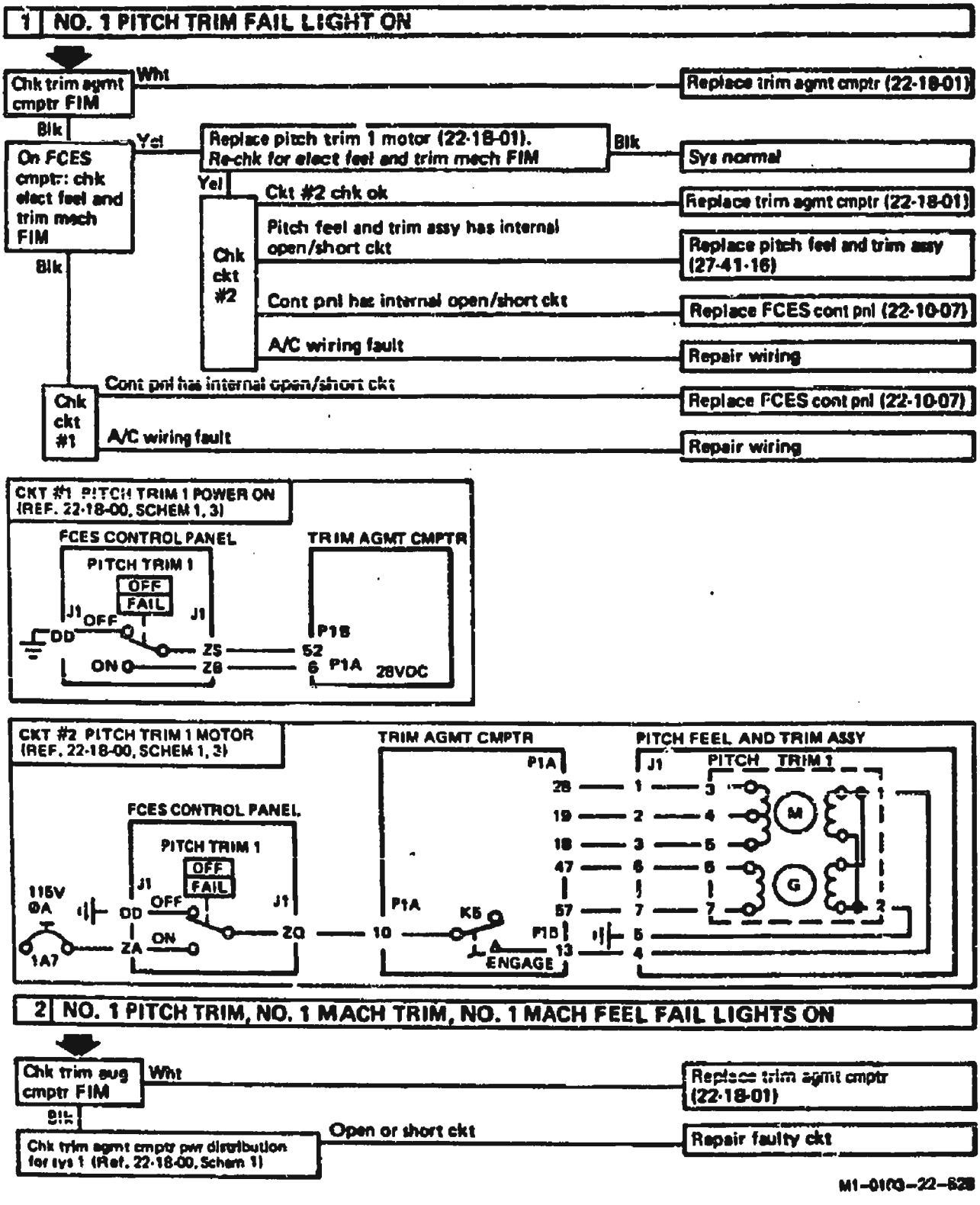
Pitch Trim Fault Matrix
Figure 103 (Sheet 3)

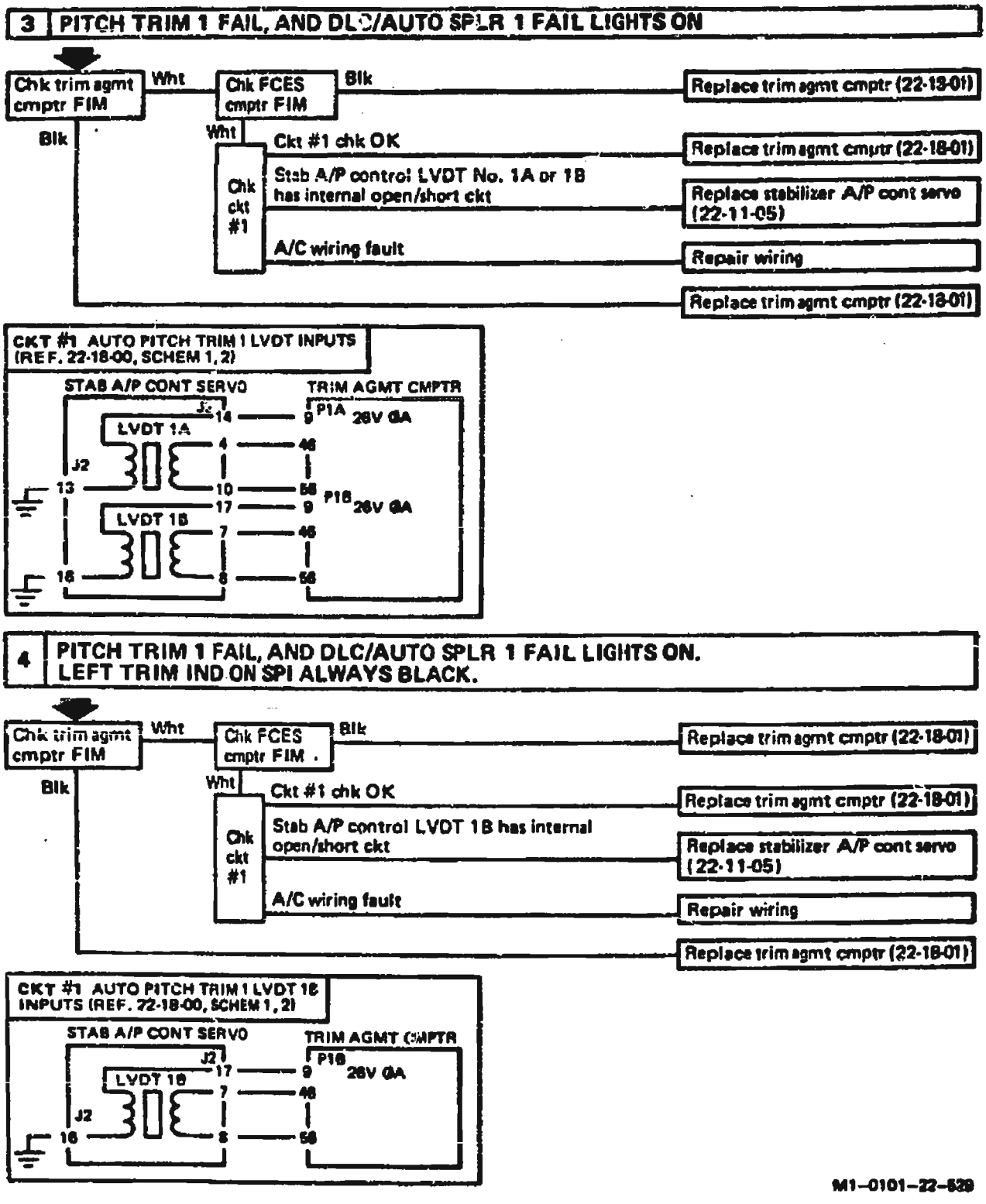
EFFECTIVITY: ALL

0018



R Automatic Pitch Trim Fault Isolation
R Figure 104 (Sheet 1)

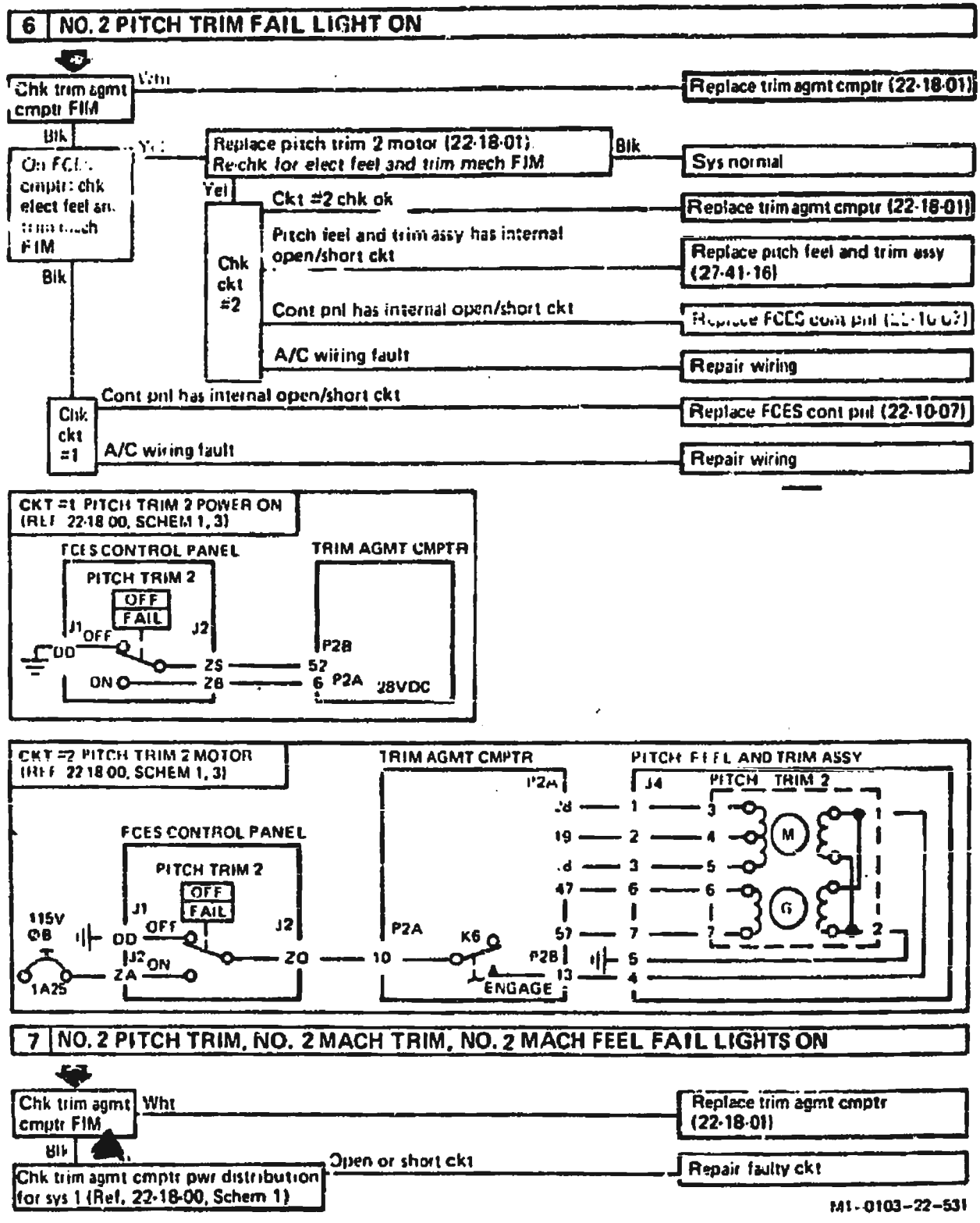
EFFECTIVITY: ALL


3 PITCH TRIM 1 FAIL, AND DLC/AUTO SPLR 1 FAIL LIGHTS ON
Chk trim agmt cmptr FIM
Wht
Chk FCES cmptr FIM
Blk
Replace trim agmt cmptr (22-13-01)
Blk
Wht
Chk ckt #1
Ckt #1 chk OK
Replace trim agmt cmptr (22-18-01)
Stab A/P control LVDT No. 1A or 1B has internal open/short ckt
Replace stabilizer A/P cont servo (22-11-05)
A/C wiring fault
Repair wiring
Replace trim agmt cmptr (22-13-01)
CKT #1 AUTO PITCH TRIM 1 LVDT INPUTS (REF. 22-18-00, SCHEM 1, 2)
STAB A/P CONT SERVO
TRIM AGMT CMPTR
LVDT 1A
LVDT 1B
J2
P1A
P1B
28V DA
4 PITCH TRIM 1 FAIL, AND DLC/AUTO SPLR 1 FAIL LIGHTS ON. LEFT TRIM IND ON SPI ALWAYS BLACK.
Chk trim agmt cmptr FIM
Wht
Chk FCES cmptr FIM
Blk
Replace trim agmt cmptr (22-18-01)
Blk
Wht
Chk ckt #1
Ckt #1 chk OK
Replace trim agmt cmptr (22-18-01)
Stab A/P control LVDT 1B has internal open/short ckt
Replace stabilizer A/P cont servo (22-11-05)
A/C wiring fault
Repair wiring
Replace trim agmt cmptr (22-18-01)
CKT #1 AUTO PITCH TRIM 1 LVDT 1B INPUTS (REF. 22-18-00, SCHEM 1, 2)
STAB A/P CONT SERVO
TRIM AGMT CMPTR
LVDT 1B
J2
P1B
28V DA
M1-0101-22-529

R Automatic Pitch Trim Fault Isolation
R Figure 104 (Sheet 2)

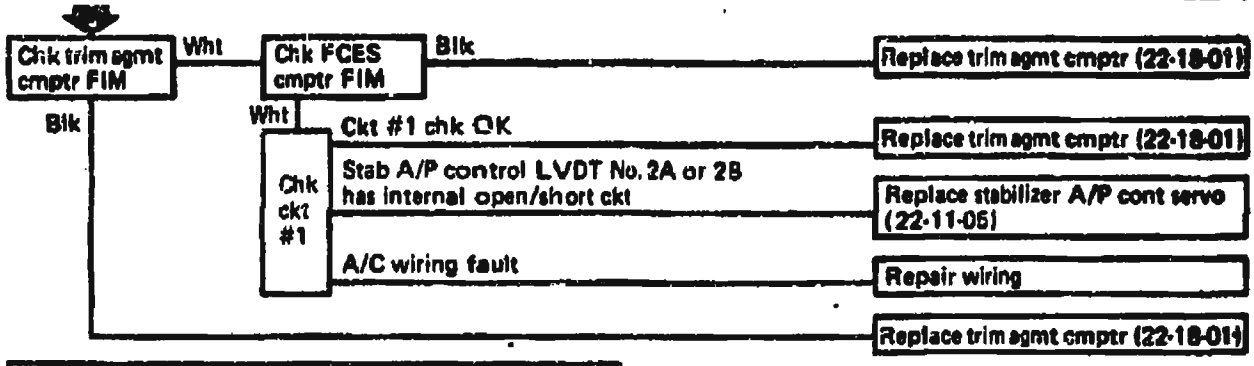
5	PITCH TRIM 1 FAIL LIGHT ON, AND BOTH MACH TRIM FAIL LIGHTS ON	
	Jam in pitch feel and trim assy gear train	Replace pitch feel and trim assy (27-41-16)

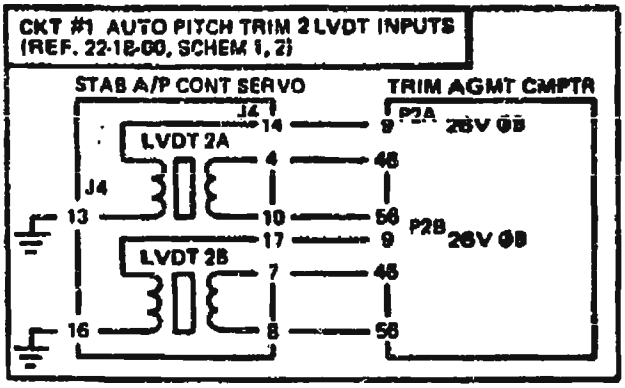
M1-0100-22-530



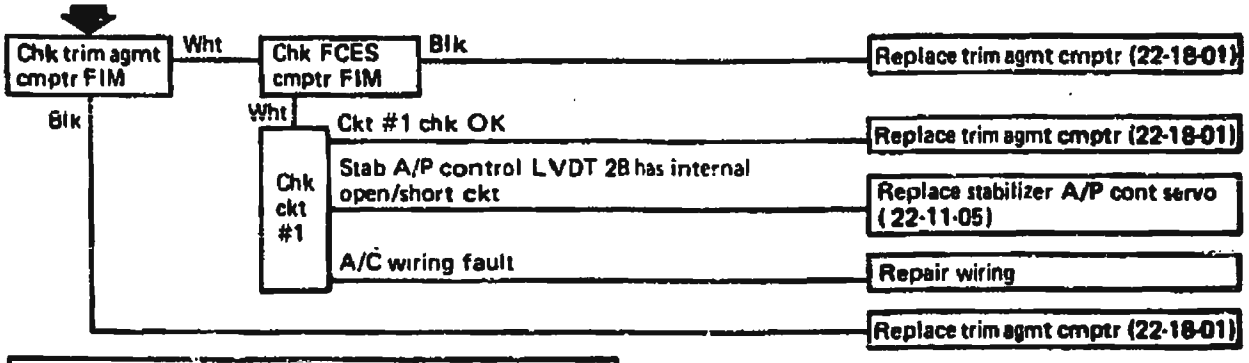
R Automatic Pitch Trim Fault Isolation
R Figure 104 (Sheet 4)

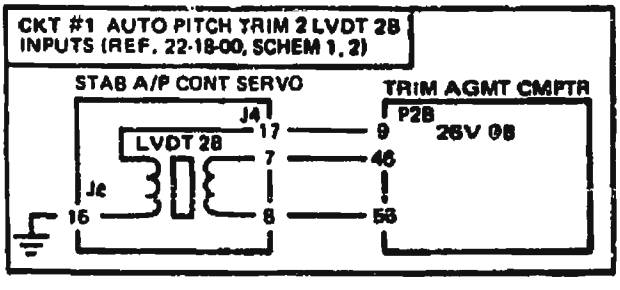
8 PITCH TRIM 2 FAIL, AND DLC/AUTO SPLR 2 FAIL LIGHTS ON





9 PITCH TRIM 2 FAIL, AND DLC/AUTO SPLR 2 FAIL LIGHTS ON. RIGHT TRIM IND ON SPI ALWAYS BLACK.





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R Automatic Pitch Trim Fault Isolation
R Figure 104 (Sheet 5)

EFFECTIVITY: ALL

001B

10 BOTH PITCH TRIM FAIL LIGHTS ON

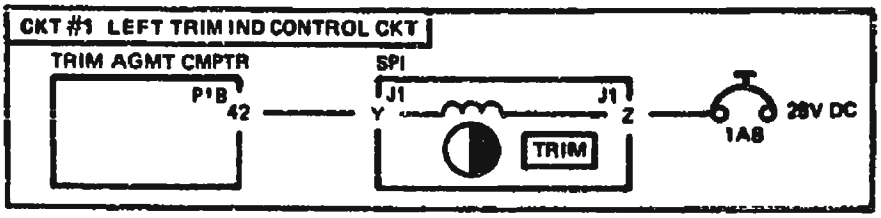
→ Replace trim agmt cmptr (22-18-01)

11 BOTH PITCH TRIM AND BOTH MACH TRIM FAIL LIGHTS ON

→ Jam in pitch feel and trim assy → Replace pitch feel and trim assy (27-41-16)

12 LEFT TRIM IND. ON SPI ALWAYS BLACK

→ Chk ckt #1
- Ckt #1 chk ok → Replace trim agmt cmptr (22-18-01)
- SPI has internal open ckt → Replace SPI (27-00-01)
- A/C wiring fault → Repair wiring

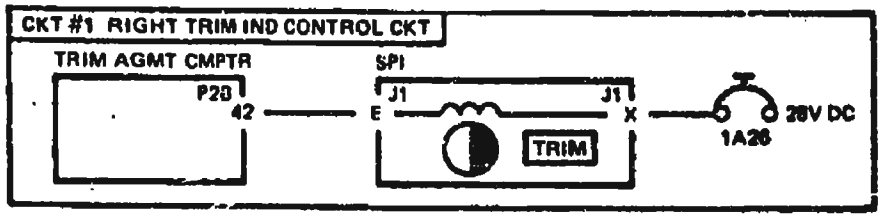


13 LEFT TRIM IND. ON SPI ALWAYS YELLOW

→ On CB1 panel: Open A8 CB
- L TRIM ind goes black → Replace trim agmt cmptr (22-18-01)
- L TRIM ind remains yellow—tap indicator if still yellow → Replace SPI (27-00-01)

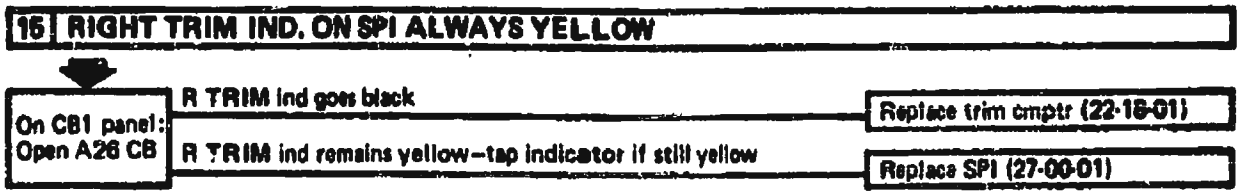
14 RIGHT TRIM IND. ON SPI ALWAYS BLACK

→ Chk ckt #1
- Ckt #1 chk ok → Replace trim agmt cmptr (22-18-01)
- SPI has internal open ckt → Replace SPI (27-00-01)
- A/C wiring fault → Repair wiring

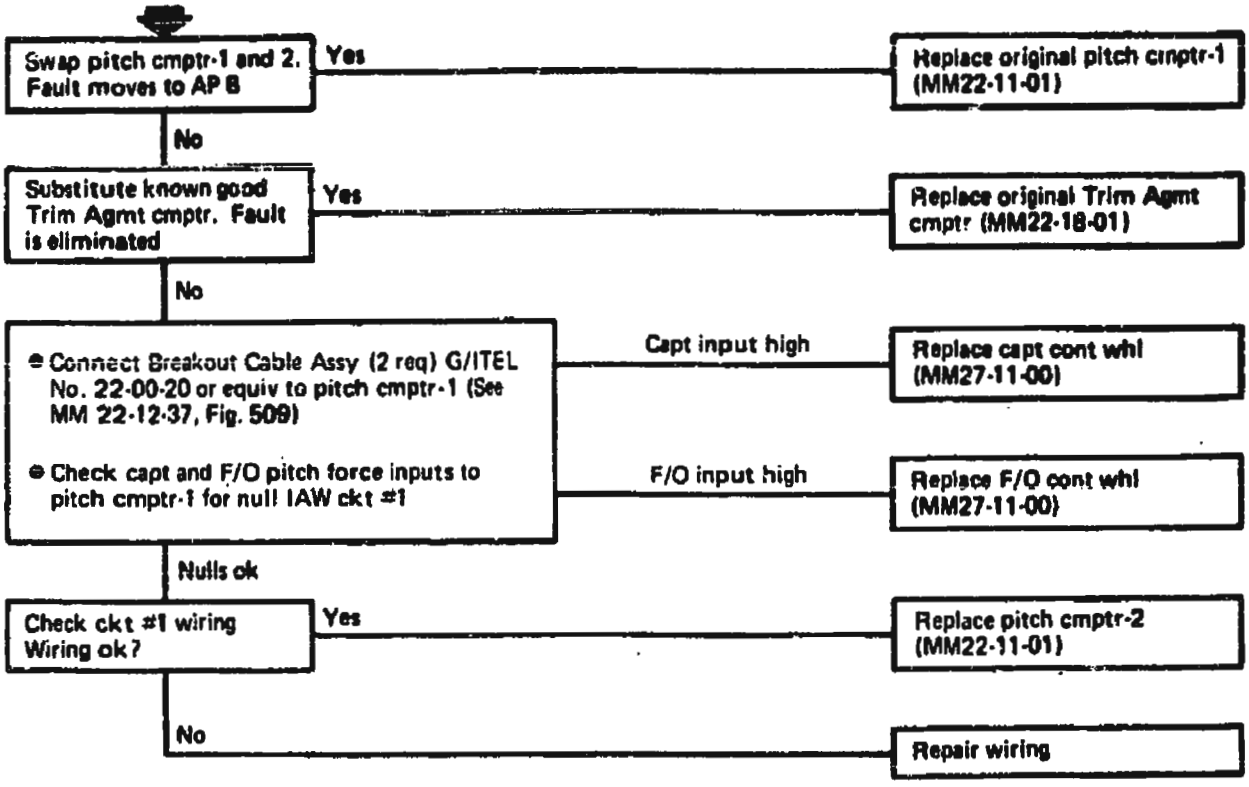


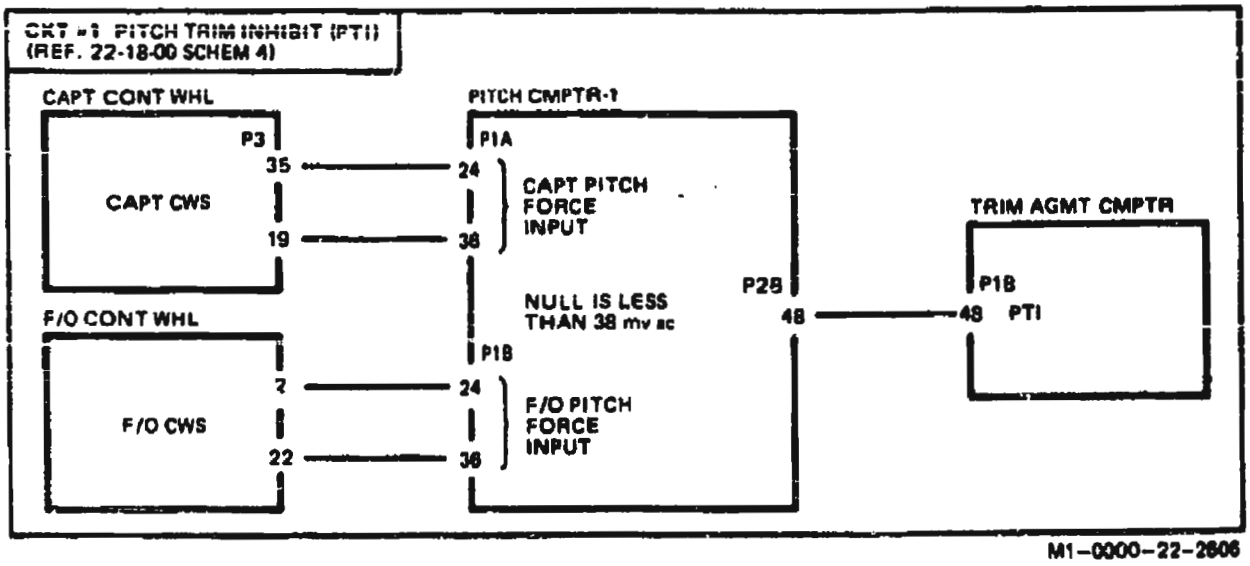
M1-0002-22-533

R Automatic Pitch Trim Fault Isolation
R Figure 104 (Sheet 6)


15 RIGHT TRIM IND. ON SPI ALWAYS YELLOW
On CB1 panel:
Open A26 CB
R TRIM ind goes black
Replace trim cmptr (22-16-01)
R TRIM ind remains yellow—tap indicator if still yellow
Replace SPI (27-00-01)

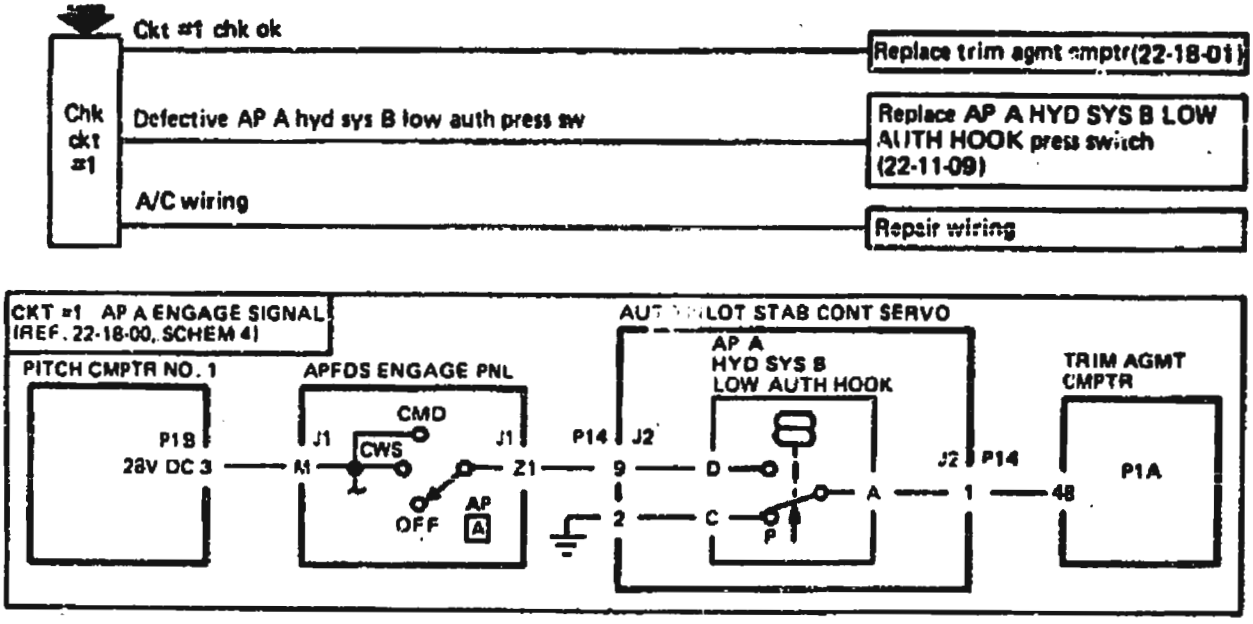
21 WITHOUT FORCE ON CONTROL WHEEL, AP A ENGAGED IN CWS OR CMD WITH NO MODES ENGAGED, AND AIRCRAFT AIRBORNE: MANUAL TRIM WHEEL FOLLOWS THUMBWHEEL.


Swap pitch cmptr-1 and 2. Fault moves to AP B
Yes
Replace original pitch cmptr-1 (MM22-11-01)
No
Substitute known good Trim Agmt cmptr. Fault is eliminated
Yes
Replace original Trim Agmt cmptr (MM22-18-01)
No
• Connect Breakout Cable Assy (2 req) G/ITEL No. 22-00-20 or equiv to pitch cmptr-1 (See MM 22-12-37, Fig. 509)
• Check capt and F/O pitch force inputs to pitch cmptr-1 for null IAW ckt #1
Capt input high
Replace capt cont whl (MM27-11-00)
F/O input high
Replace F/O cont whl (MM27-11-00)
Nulls ok
Check ckt #1 wiring Wiring ok?
Yes
Replace pitch cmptr-2 (MM22-11-01)
No
Repair wiring



R Manual Override of Automatic Pitch Trim Fault Isolation
R Figure 105 (Sheet 1)

22	WITHOUT FORCE ON CONTROL WHEEL, AP A ENGAGED IN CWS OR CMD WITH NO MODES ENGAGED, AND AIRCRAFT AIRBORNE: A/P LIMIT MESSAGE AND MANUAL TRIM WHEEL FOLLOWS THUMBWHEEL



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R Manual Override of Automatic Pitch Trim Fault Isolation
R Figure 105 (Sheet 2)

EFFECTIVITY: ALL

0018

23 WITHOUT FORCE ON CONTROL WHEEL, AP B ENGAGED IN CWS OR CMD WITH NO MODES ENGAGED, AND AIRCRAFT AIRBORNE: MANUAL TRIM WHEEL FOLLOWS THUMBWHEEL

Swap pitch cmptr 1 and 2. Fault moves to AP A — Yes → Replace original pitch cmptr-2 (MM22-11-01)

No

Substitute known good Trim Agmt cmptr. Fault is eliminated — Yes → Replace original Trim Agmt cmptr (MM22-18-01)

No

- Connect Breakout Cable Assy (2 req) G/ITEL No. 22-00-00 or equiv to pitch cmptr-2 (See MM22-12-37, Fig. 509)
- Check capt and F/O pitch force inputs to pitch cmptr-2 for null IAW ckt #1

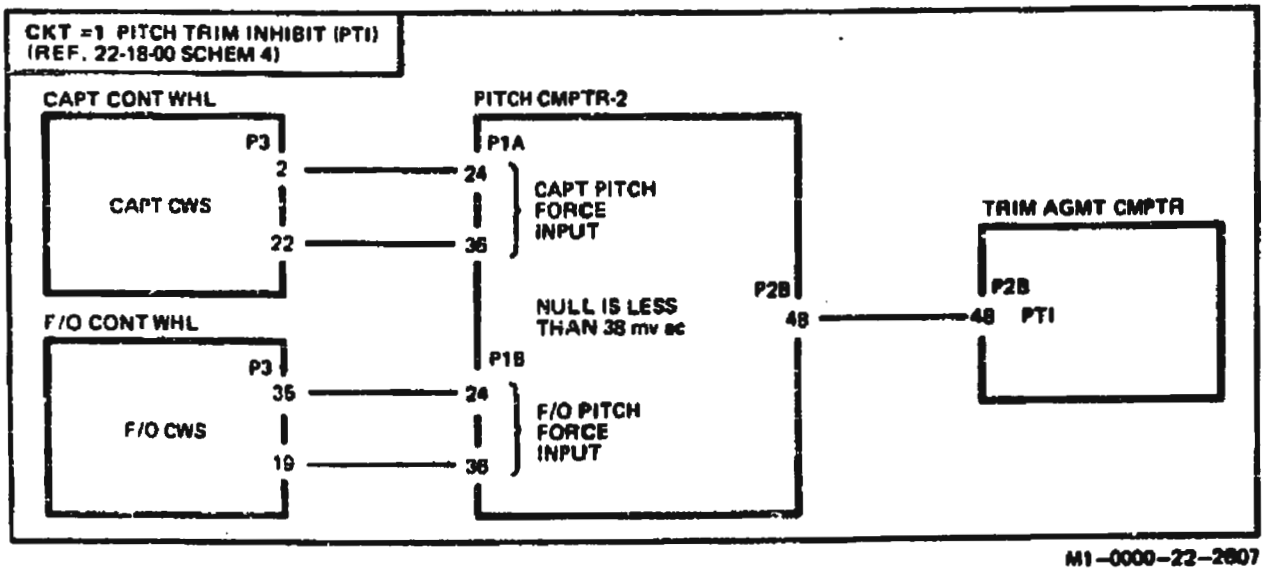
Capt input high → Replace capt cont whl (MM27-11-00)

F/O input high → Replace F/O cont whl (MM27-11-00)

Nulls ok

Check ckt #1 wiring Wiring ok? — Yes → Replace pitch cmptr-1 (MM22-11-01)

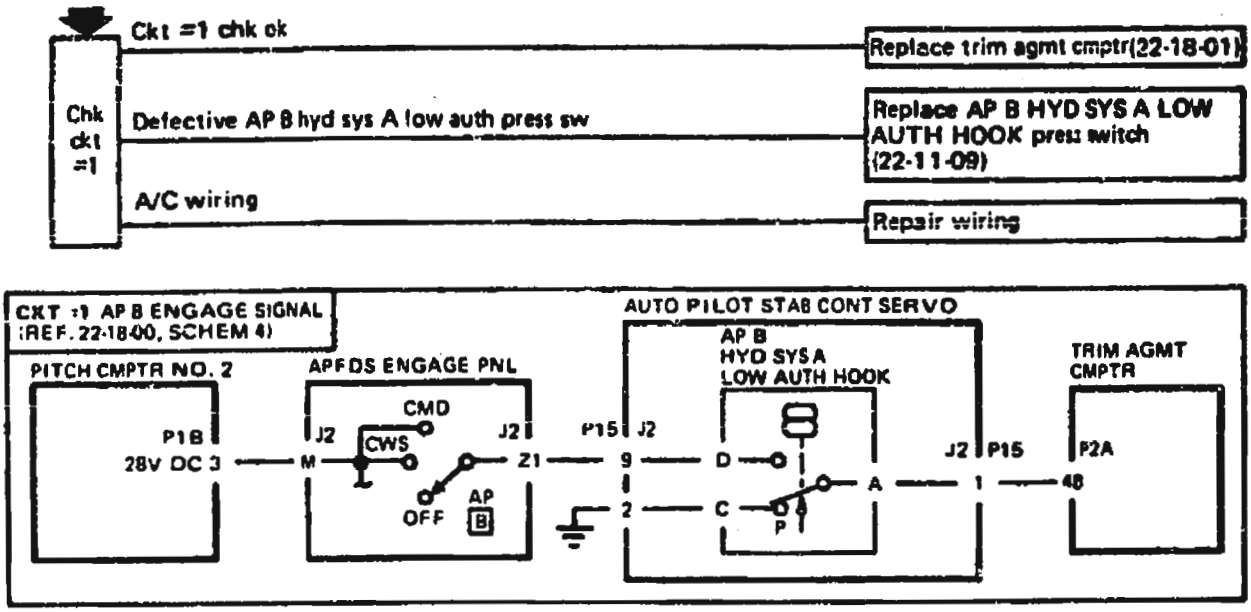
No → Repair wiring



M1-0000-22-2807

R R Manual Override of Manual Pitch Trim Fault Isolation
Figure 105 (Sheet 3)

24	WITHOUT FORCE ON CONTROL WHEEL, AP B ENGAGED IN CWS OR CMD WITH NO MODES ENGAGED, AND AIRCRAFT AIRBORNE: A/P LIMIT MESSAGE AND MANUAL TRIM WHEEL FOLLOWS THUMBWHEEL



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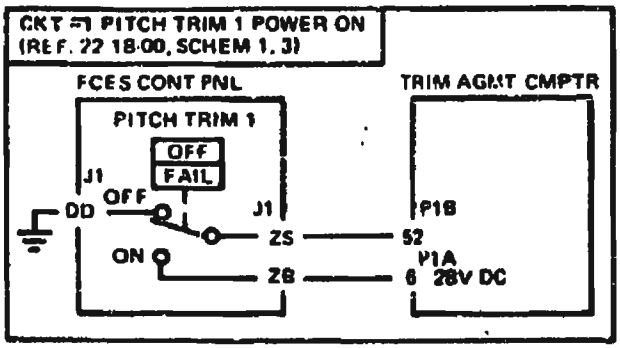
R Manual Override of Automatic Pitch Trim Fault Isolation
R Figure 105 (Sheet 4)

31 PITCH TRIM 1 FAIL LIGHT ON

Chk trim agmt cmptr FIM
- Wht → Replace trim agmt cmptr (22-18-01)
- Blk → Chk ckt #1
  - Ckt #1 ch OK → Replace trim agmt cmptr (22-18-01)
  - Cont pnl has internal open/short ckt → Replace FCES cont pnl (22-10-07)
  - A/C wiring fault → Repair wiring



32 PITCH TRIM 1, MACH TRIM 1, MACH FEEL 1 FAIL LIGHTS ON

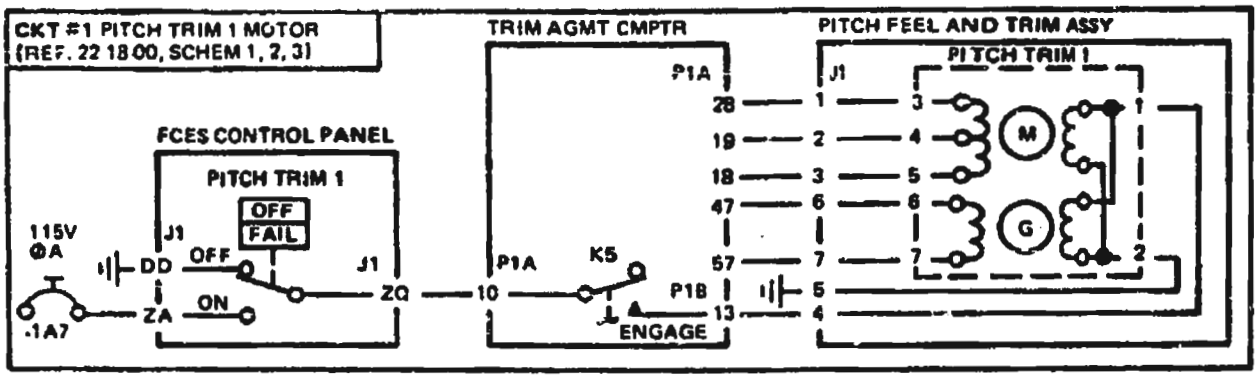
Chk trim agmt cmptr FIM
- Wht → Replace trim agmt cmptr (22-18-01)
- Blk → Chk trim agmt cmptr pwr distribution for sys 1 (Ref. 22-18-00, Fig. 101)
  - Open/short ckt → Repair faulty ckt

M1-0101-22-576

Manual Pitch Trim Fault Isolation
Figure 106 (Sheet 1)

33 PITCH TRIM 1 FAIL LIGHT COMES ON WHEN ROTATING THUMBWHEEL

- Chk trim agmt cmptr FIM
  - Wht → Replace trim agmt cmptr (22-18-01)
  - Blk → On FCES cmptr: chk elect feel and trim mech FIM
    - Yel → Replace pitch trim 1 motor (22-18-10). Re-chk for elect feel and trim mech FIM
      - Blk → Sys normal
      - Yel → Chk ckt #1
        - Ckt #1 chk OK → Replace trim agmt cmptr (22-18-01)
        - Pitch feel and trim assy has internal open/short ckt → Replace pitch feel and trim assy (27-41-16)
        - Cont pnl has internal open/short ckt → Replace FCES cont pnl (22-10-07)
        - A/C wiring fault → Repair wiring
    - Blk → Replace trim agmt cmptr (22-18-01)



34 PITCH TRIM 1 FAIL LIGHT COMES ON WHEN ROTATING THUMBWHEEL. BOTH MACH TRIM FAIL LIGHTS ON

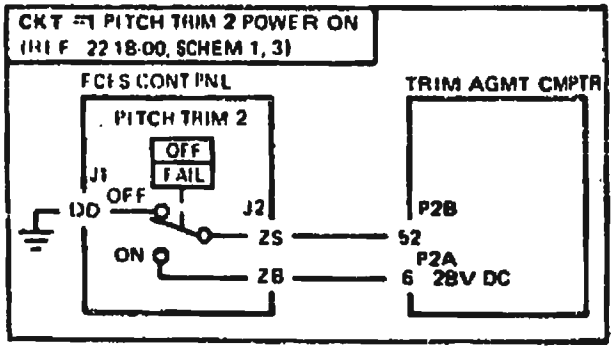
- Jam in pitch feel and trim assy → Replace pitch feel and trim assy (27-41-16)

M1-0102-22-537

Manual Pitch Trim Fault Isolation
Figure 106 (Sheet 2)

35 PITCH TRIM 2 FAIL LIGHT ON

Chk trim agmt cmptr FIM
- Wht → Replace trim agmt cmptr (22-18-01)
- Blk → Chk ckt #1
  - Ckt #1 ch OK → Replace trim agmt cmptr (22-18-01)
  - Cont pnl has internal open/short ckt → Replace FCES cont pnl (22-10-07)
  - A/C wiring fault → Repair wiring



36 PITCH TRIM 2, MACH TRIM 2, MACH FEEL 2 FAIL LIGHTS ON

Chk trim agmt cmptr FIM
- Wht → Repalce trim agmt cmptr (22-18-01)
- Blk → Chk trim agmt cmptr pwr distribution for sys 2 (Ref. 22-18-00, Schem 1)
  - Open/short ckt → Repair faulty ckt

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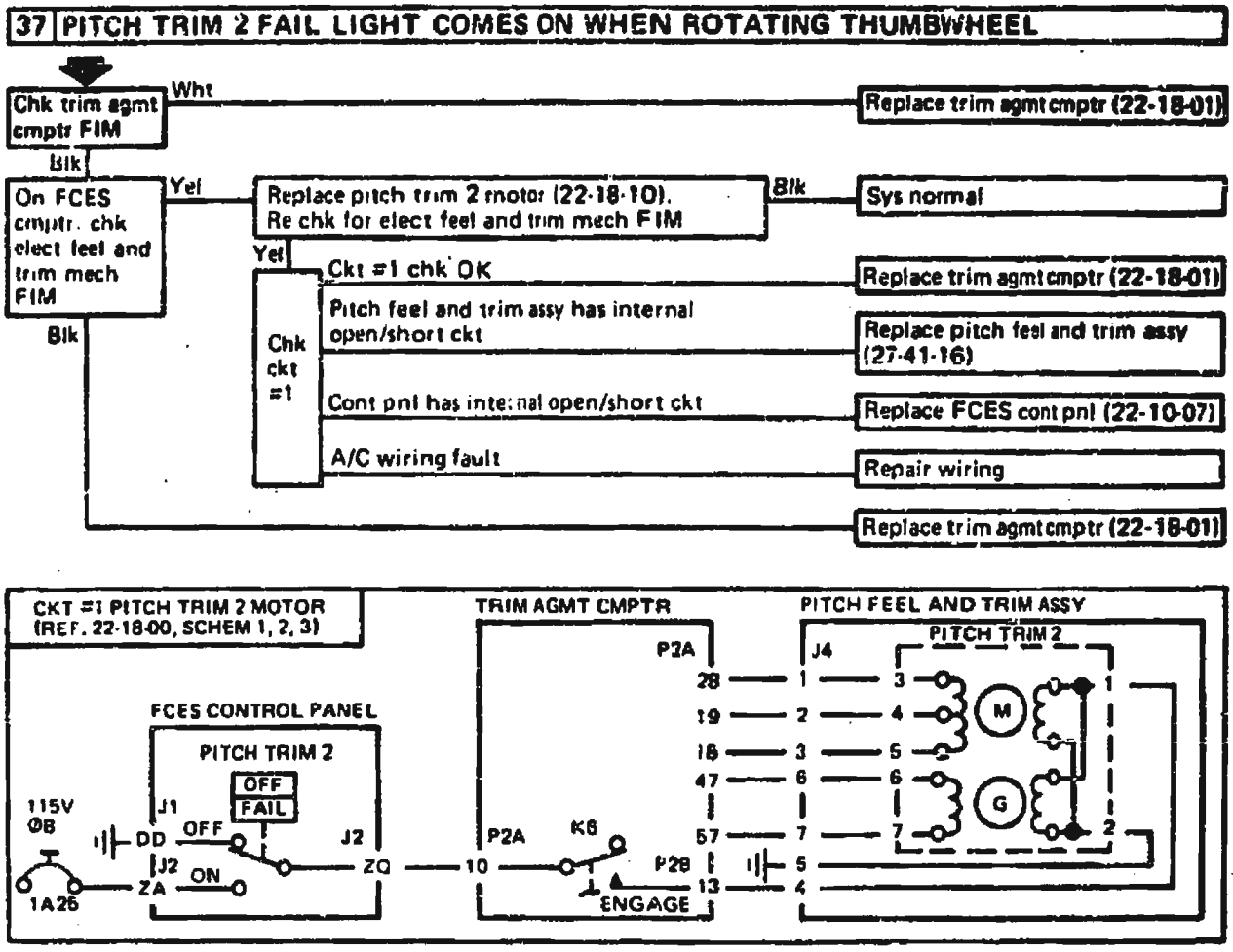
Manual Pitch Trim Fault Isolation
Figure 106 (Sheet 3)



M1-0102-22-539

Manual Pitch Trim Fault Isolation
Figure 106 (Sheet 4)

38 BOTH PITCH TRIM FAIL LIGHTS ON

→ Replace trim agmt cmptr (22-18-01)

39 BOTH PITCH FAIL LIGHTS COME ON WHEN ROTATING THUMBWHEEL

Chk trim agmt cmptr FIM — Wht → Replace trim agmt cmptr (22-18-01)

Blk

On FCES cmptr chk CW1 and CW2 FIM

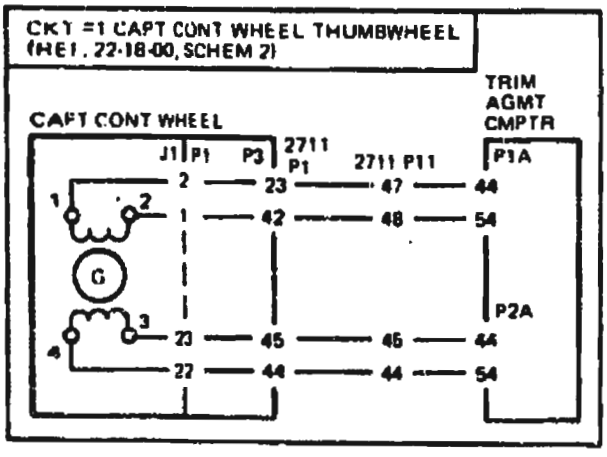
CONTROL WHEEL 1 Yel → Chk ckt #1

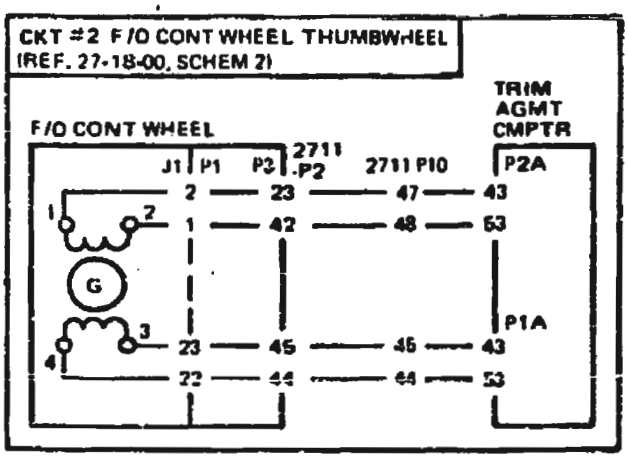
- Ckt #1 chk ok → Replace trim agmt cmptr (22-18-01)
- Capt gen has internal open/short ckt → Replace Capt generator (22-10-23)
- Capt CW has internal open/short ckt → Replace Capt cont wheel (27-11-01)
- A/C wiring fault → Repair wiring

CONTROL WHEEL 2 Yel → Chk ckt #2

- Ckt #2 chk ok → Replace trim agmt cmptr (22-18-01)
- F/O gen has internal open/short ckt → Replace F/O generator (22-10-23)
- F/O CW has internal open/short ckt → Replace F/O cont wheel (27-11-01)
- A/C wiring fault → Repair wiring

Blk → Replace trim agmt cmptr (22-18-01)





M1-0102-22-540

Manual Pitch Trim Fault Isolation
Figure 106 (Sheet 5)

40 WHEN ROTATING THUMBWHEEL, MANUAL TRIM WHEEL DOES NOT FOLLOW. PITCH TRIM FAIL LIGHTS "DO NOT" COME ON.
(-1 = A/P A ENG WHEN PROBLEM OCCURRED.)
(-2 = A/P B ENG WHEN PROBLEM OCCURRED.)
(-3 = A/P NOT ENG WHEN PROBLEM OCCURRED)

-1 OR -2

Engage opposite A/P. Rotate thumbwheel

Manual trim wheel "does not" follow → Go to -3

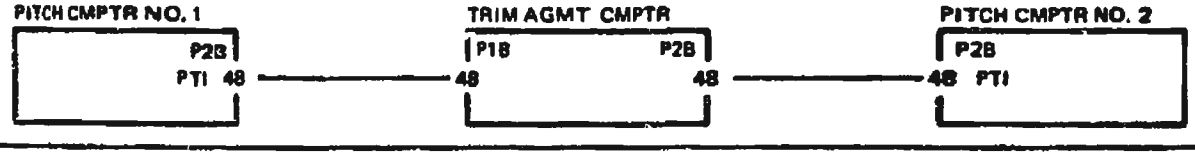
Manual trim wheel follows

Problem is loss of PTI signal. Ch ckt #1

Ckt #1 ch OK → Replace trim agmt cmptr (22-18-01) If problem persists, replace pitch cmptr on side of fault (22-11-01)

A/C wiring fault → Repair wiring

CKT #1 PITCH TRIM INHIBIT (PTI) (REF. 22-18-00, SCHEM 4)



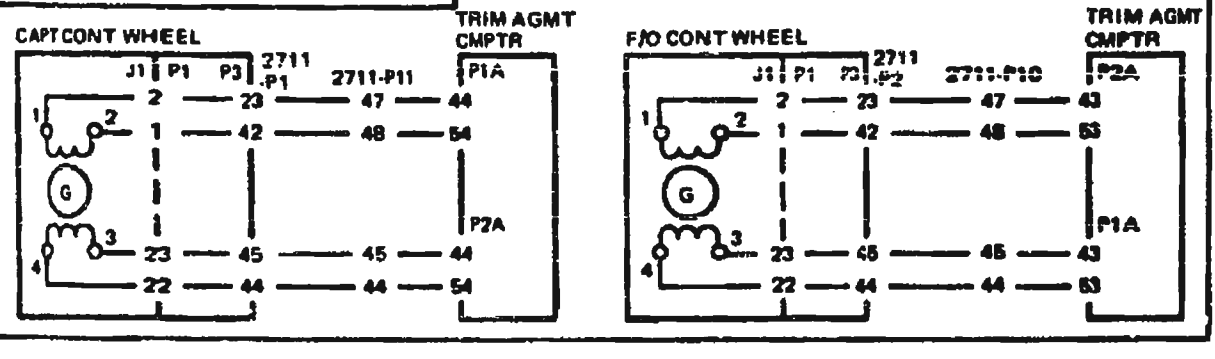
-3

Alternately rotate Capt then F/O thumbwheels and have another person listen for operation of pitch trim motors, and ball detent clutch in elec pitch feel and trim assy (left side)

Clutch slips → High friction or jam in pitch trim sys (Ref. 27-42-00)

Clutch does not slip, no sound of running motors → Chk ckt #2. (Open ckt between Capt/FO cont wheels and trim agmt cmptr)

CKT #2 CAPT/FO CONT WHEEL THUMBWHEEL (REF. 22-18-00, SCHEM 2)



M1-0102-27-541

Manual Pitch Trim Fault Isolation
Figure 106 (Sheet 6)

41	BOTH PITCH TRIM FAIL LIGHTS COME ON WHEN ROTATING THUMBWHEEL. BOTH MACH TRIM FAIL LIGHTS ON

Jam in pitch feel and trim assembly → Replace pitch feel and trim assembly (27-41-16)

42	WHEN ROTATING THUMBWHEEL, MANUAL TRIM WHEEL DOES NOT ROTATE SMOOTHLY, OR IT BINDS UP, OR JAMS. PITCH TRIM FAIL LIGHTS "DO NOT" COME ON

→ Check pitch trim cable system for excess friction (27-42-00)

M1-0100-22-842

Manual Pitch Trim Fault Isolation
Figure 106 (Sheet 7)

B. System Oriented Fault Isolation

R Table 102 contains the pitch trim fault isolation procedure. See 22-21-00 for Mach Trim and Feel System Schematics and fault isolation.

The fault isolation procedure (Ref. Table 102) consists of a test procedure, normal observations, faults and corrective actions. The test procedure and normal observations are used to verify the operational status of the system. When a fault occurs during the test, perform corrective actions adjacent to fault indication.

R If troubleshooting procedures as outlined in this section do not isolate the problem, consult the wiring diagram manual and use the signal intercept cables (G/ITEL No. 22-00-19) for further analysis and isolation of the problem. The signal intercept cable (T-Cable) permits monitoring of trim augmentation computer input/output functions with the systems fully operational.

Pitch Trim Fault Isolation
Table 102

SET UP	ACTION	CHECK
1.	Turn on electrical power (Ref. 24-00-00).	
2.	.....	Avionics cooling is on. (Ref. 21-25-00.)
3.	.....	On APFDS ENGAGE panel, verify that FD, A and B, and AP engage A and B switches are set to OFF.
4.	.....	On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed: AUTO THROT SERVO (A1) SPEED CONT (A2) (A20) YAW SAS (A5) (A23) PITCH & ROLL (A6) (A24) TRM AGMT AC (A7) (A25) TRM AGMT DC (A8) (A26) AFCS MODE IND (B1) (B19) FCES COMPUTERS DC (B4) FCES COMPUTERS AC & LAOA (B5) STICK SHAKE (B6) SPOILER DWELL DC (B7) SPOILER DWELL AC (B8) NO. 1 AFT COUPLER (B9) NO. 2 AFT COUPLER (B27)
5.	.....	On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed: AFCS WARNING CAPT (K18) AFCS WARNING F/O (K19)

Pitch Trim Fault Isolation (Cont)
Table 102

SET UP	ACTION	CHECK
	WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM: LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED. TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT. THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.	
	6. Turn on hydraulic systems A, B, C and D (Ref. 29-11-00).	
	7. Zero PITCH trim wheel (5.5 degrees).	

Pitch Trim Fault Isolation
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
A. Check FIM on trim aug and FCES computers.	Trim aug computer FIM: • Black. FCES computer FIM: • CONTROL WHEEL 1 black. • CONTROL WHEEL 2 black. • ELEC FEEL & TRIM MECH black.	Test OK.
	Trim aug computer FIM white.	Bad trim aug computer. Reset FIM, and confirm fault by continuing procedure.
	CONTRCL WHEEL 1 FIM yellow.	Bad Capt control wheel. Reset FIM, and confirm fault by continuing procedure.

Pitch Trim Fault Isolation (Cont)
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	CONTROL WHEEL 2 FIM yellow.	Bad F/O control wheel. Reset FIM, and confirm fault by continuing procedure.
	ELEC FEEL & TRIM MECH FIM yellow.	Bad electrical pitch feel trim assembly. Reset FIM, and confirm fault by continuing procedure.
NOTE: *FIM is operational with Trim Aug Computer with Collins S/B 7 and S/B 9.		
B. FCES panel. • Depress PITCH TRIM 1 and 2 to on.	PITCH TRIM lights dark.	Test OK.
	PITCH TRIM 1 or 2 FAIL plus FLT CONT PANELS legend.	On CB1, check A7, A8 circuit breakers for sys No. 1, and A25, A26 circuit breakers for sys No. 2. Replace trim aug computer.
C. First on Capt, then on F/O control wheel: • Rotate thumbwheel NOSEDOWN until manual trim wheel indicates 0 deg. • Rotate thumb-wheel NOSE-UP until manual trim wheel indicates 10 deg.	SPI • STAB TRIM ind moves to approx. 0 deg, then to 10 deg. Control columns • Move forward then aft. Manual trim wheel • Rotates smoothly and without binding to 0 deg then to 10 deg.	Test OK.

Pitch Trim Fault Isolation (Cont)
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	NOTE: • Approx. 4 complete revolutions from 0 deg to 10 deg.	
	Manual trim wheel does not rotate smoothly, or it binds up, or jams.	Check cable system for excess friction (Ref. 27-42-00).
	Manual trim wheel does not rotate 4 revolutions, and STAB TRIM ind does not change over 0 deg to 10 deg range.	Check trim system rigging. (Ref. 27-42-00)

Pitch Trim Fault Isolation (Cont)
Table 102

	PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R		PITCH TRIM 1 and 2 FAIL while rotating either Capt or F/O thumbwheel.	Check trim aug computer seating, and FIM. • Reseat or replace trim aug computer as required and repeat test (Ref. 22-18-01). Check CONTROL WHEEL 1 and 2 FIM on FCES computer. If yellow: • With PITCH TRIM 1 only on, rotate thumbwheel on FIM-indicated control wheel. If manual control wheel does not rotate, replace generator on control wheel (Ref. 22-10-23), or check channel 1 wiring from control wheel to trim aug computer (Ref. WM 22-18-03). • With PITCH TRIM 2 only on, rotate thumbwheel on FIM-indicated control wheel. If manual control wheel does not rotate, replace generator on control wheel (Ref. 22-10-23) or check channel 2 wiring control wheel to trim aug computer (Ref. WM 22-18-04). Check ELEC FEEL & TRIM MECH FIM on FCES computer. If yellow: • Replace jammed electrical pitch feel trim assembly (Ref. 27-41-16).

Pitch Trim Fault Isolation (Cont)
Table 102

	PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R		PITCH TRIM 1 or 2 FAIL (not both) while rotating thumbwheel.	Check trim aug computer seating and FIM. • Reseat computer or replace as required (Ref. 22-18-01). Check ELEC FEEL & TRIM MECH FIM on FCES computer. If yellow: • Replace associated pitch trim motor (Ref. 22-18-10). • Replace electrical pitch feel trim assembly (Ref. 27-41-16). • Check wiring between trim aug computer and electrical pitch feel trim assembly (Ref. WM 22-18-03 and 22-18-04).
R R		Control column does not move. No PITCH TRIM FAIL light.	Alternately rotate Capt then F/O thumbwheels and have another person listen for operation of pitch trim motors, and ball detent clutch in electric pitch feel and trim assembly (left side). • Clutch slips, high friction or jam in pitch trim system (Ref. 27-42-00). • Clutch does not slip, no sound of motors running. Check electrical connectors between Capt and F/O control wheel and trim aug computer (Ref. WM 22-18-03 and 22-18-04).

Pitch Trim Fault Isolation (Cont)
Table 102

	PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	D. Set manual trim wheel to 5.5 deg. Lower flaps to 33 degrees.	SPI • STAB TRIM ind, approx. 5.5 deg.	No test.
	E. FESC, center rack • Remove AFCS/MLG accessory unit.	Simulates aircraft airborne.	No test.
	F. APFDS engage panel • Set AP engage sw A to CMD.	Auto trim is engaged	No test.
	G. FCES panel • Depress PITCH TRIM 2 to OFF.	AP engage sw A remains in CMD.	Test OK.
R		AP engage A sw drop to OFF.	Replace trim aug computer (Ref. 22-18-01). Replace pitch computer No. 1 (Ref. 22-11-01).
	H. Capt control wheel • Rotate thumbwheel NOSE-UP.	Manual trim wheel • No movement.	Test OK.
R		Manual trim wheel • Rotates.	Loss of pitch trim inhibit (PTI) signal • Replace pitch computer No. 1 (Ref. 22-11-01). • Replace trim aug computer.

Pitch Trim Fault Isolation (Cont)
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
I. Capt control wheel • Pull aft slightly and simultaneously rotate thumbwheel NOSE-UP. • Release force on control wheel.	Control columns. • Move aft. Manual trim wheel • Move in same direction as thumbwheel.	Test OK.
	Manual trim wheel does not rotate with force on control wheel.	Replace pitch computer No. 1 (Ref. 22-11-01). Replace Capt control wheel (Ref. 27-11-01). Check wiring between Capt control wheel and pitch computer No. 1 [Ref. 22-00-00) (SCHEM 8), WM 22-11-03 and 22-11-04].
J. HEADING/ PITCH MODE panel. • Depress VS to on.	Both ann. • VS displayed.	No test.
K. HEADING/ PITCH MODE panel. • Set VERT SPEED to plus 200 FPM (blue).	Control columns. • Move aft and stop. Manual trim wheel. • Rotates nose-up and stop. SPI • Trim No. 1 and No. 2 annunciators yellow. AP LIMIT message with flashing ALERT.	Test OK.

Pitch Trim Fault Isolation (Cont)
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Control columns. • Does not move.	• On CB1, open A24 CB. Repeat test. • Control column moves, replace pitch computer No. 2 (Ref. 22-11-01). • Control column does not move, replace pitch computer No. 1. • Close A24 CB.
	No trim No. 1 or No. 2 indication on SPI annunciator.	Replace SPI (Ref. 27-00-01). Replace trim aug computer (Ref. 22-18-01).
	PITCH TRIM 1 FAIL and No trim No. 1 SPI annunciator indication.	Replace trim aug computer (Ref. 22-18-01). Check for open ckt between following: trim aug computer P1B-46 and stab AP control servo P14-7, P1B-56 and P14-8, P1B-9 and P2-17 [Ref. SCHEM 1 and 2 (Sheet 1), and WM 22-18-03, 22-18-05 and 22-18-07]. Replace stab AP control servo (Ref. 22-11-05).
	PITCH TRIM 1 FAIL and No manual trim wheel movement.	Replace trim aug computer (Ref. 22-18-01). Check for open ckt between following: trim aug computer P1A-46 and stab AP control servo P14-4, P1A-56 and P14-10, P1A-9 and P2-14 [Ref.SCHEM 1 and and 2 (Sheet 1) and WM 22-18-03, 22-18-05 and 22-18-07]. Replace stab AP control servo (Ref. 22-11-05).

Pitch Trim Fault Isolation (Cont)
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Manual trim wheel. • Does not move.	Replace trim aug computer (Ref. 22-18-01).
L. Set VERT SPEED to -200 FPM until control column and manual trim wheel move to condition prior to Step K. Set VERT SPEED to 0 FPM.		No test.
M. Depress PITCH TRIM 1 to OFF.	AP engage sw A. • Drops to OFF. AP DISC message with ALERT	Test OK.
	AP engage A sw does not drop to OFF.	Replace pitch computer No. 1 (Ref. 22-11-01). Replace trim aug computer (Ref. 22-18-01).
N. Depress PITCH TRIM 1 and 2 to on.		
O. Set manual trim wheel to 5.5 deg.	SPI • STAB TRIM ind. approx. 5.5 deg.	No test.
P. APFDS engage panel. • Set AP engage sw B to CMD.	Auto trim is engaged.	No test.
Q. On CB1, open A6 CB.		No test.
R. FCES panel • Depress PITCH TRIM 1 to OFF.	AP engage sw B remains in CMD.	Test OK.

Pitch Trim Fault Isolation (Cont)
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	AP engage sw B drops to OFF.	Replace trim aug computer (Ref. 22-18-01). Replace pitch computer No. 2 (Ref. 22-11-01).
S. F/O control wheel • Rotate thumbwheel NOSE-UP.	Manual trimwheel. • No movement	Test OK.
	Manual trim wheel • Rotates	Loss of pitch trim inhibit (PTI) signal. • Replace pitch computer No. 2 (Ref. 22-11-01). • Replace trim aug computer (Ref. 22-18-01).
T. F/O control • Pull aft slightly and simultaneously rotate thumbwheel NOSE-UP.	Control columns. • Move aft. Manual trimwheel • Moves in same direction as thumbwheel.	Test OK.
	Manual trim wheel does not rotate with force on control wheel.	Replace pitch computer No. 2 (Ref. 22-11-01). Replace F/O control wheel (Ref. 27-11-01). Check wiring between F/O control wheel and pitch computer No. 2 (Ref. 22-00-00 (SCHEM 9) and WM 22-11-03 and 22-11-04].
U. Depress VS to on.	Both ann. • VS displayed.	No test.

Pitch Trim Fault Isolation (Cont)
Table 102

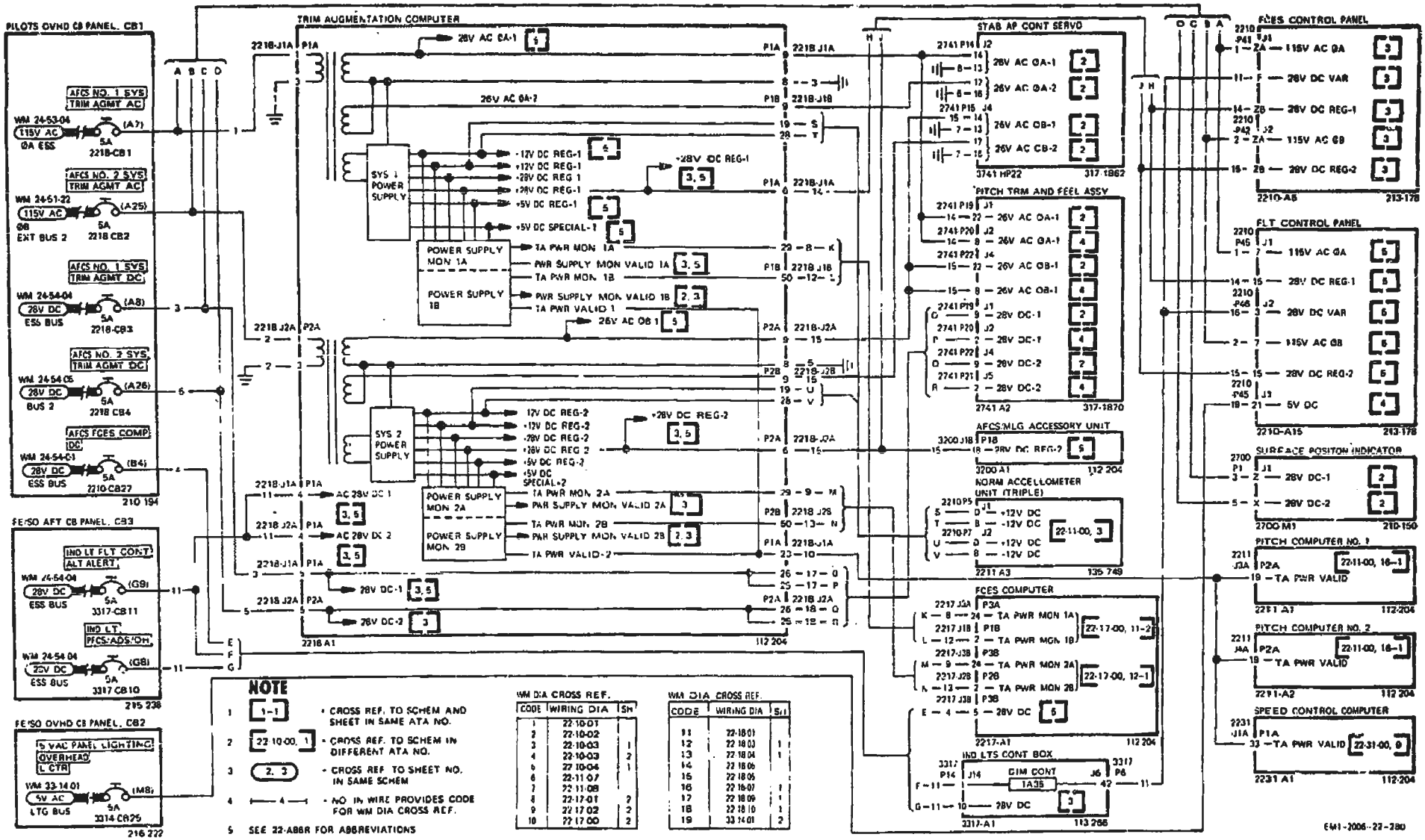
PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
V. Set VERT SPEED plus 200 FPM (blue).	Control columns. • Move aft and stop. Manual trim wheel. • Rotates nose-up to 10 deg. and stops. SPI • Trim No. 2 annunciator yellow. AP LIMIT message with flashing ALERT.	Test OK.
	No trim No. 2 SPI indication.	Replace SPI (Ref. 27-00-01). Replace trim aug computer (Ref. 22-18-01).
	PITCH TRIM 2 FAIL and No trim No. 2 SPI annunciator indication.	Replace trim aug computer (Ref. 22-18-01). Check for open ckt between following: trim aug computer J2B-46 and stab AP control servo P15-7, J2B-56 and P15-8 (Ref. SCHEM 2 (Sheet 1) and WM 22-18-04), J2A-9 and J2-14 (Ref. SCHEM 1 and WM 22-18-06). Replace stab AP control servo (Ref. 22-11-05).
	PITCH TRIM 2 FAIL and No manual trim wheel movement.	Replace trim aug computer (Ref. 22-18-01). Check for open ckt between following: trim aug computer J2A-46 and stab AP control servo P15-4, J2A-56 and P15-10 (Ref. SCHEM 2 (Sheet 1) and WM 22-18-04), J28-9 and P15-17 (Ref. WM 22-18-06). Replace stab AP control servo (Ref. 22-11-05).

Pitch Trim Fault Isolation (Cont)
Table 102

PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Control column. • Does not move.	Replace pitch computer No. 2 (Ref. 22-11-01).
	Manual trim wheel. • Does not move.	Replace trim aug computer (Ref. 22-18-01).
W. Set VERT SPEED to -200 FPM until control column and manual trim wheel move to condition prior to Step V. Set VERT SPEED to 0 FPM.		No test.
X. Depress PITCH TRIM 2 to OFF.	AP engage sw B. • Drop to OFF. AP DISC message with ALERT.	Test OK.
	AP engage sw B does not drop to OFF.	Replace pitch computer No. 2 (Ref. 22-11-01). Replace trim aug computer (Ref. 22-18-01).
Y. Control wheel • Depress A/P DISC sw.	AP DISC messages removed.	No test.
Z. On CB 1, close A6 CB.		No test.
AA. Install AFCS/MLG accessory unit.		No test.
AB. Set flaps to 0 degrees.		No test.

Pitch Trim Fault Isolation (Cont)
Table 102

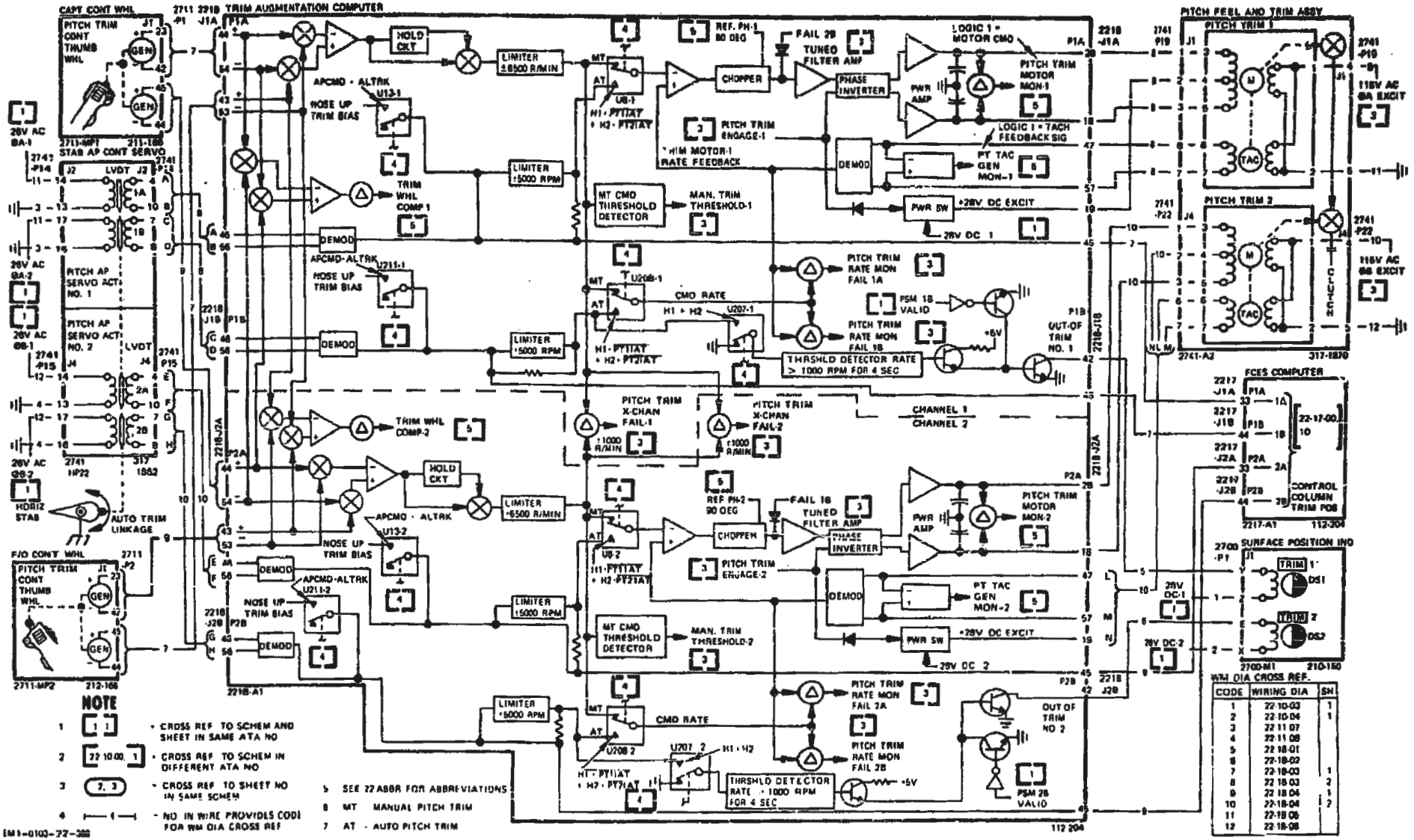
PROCEDURE	OBSERVATIONS FAULTS	CORRECTIVE ACTION
NOTE:		INU BATTERIES MAY BE DISCHARGED UPON REMOVAL OF AIRCRAFT POWER IF MODE SELECTOR SWITCH IS NOT SET TO OFF.
AC.	Set all mode selector switches to OFF	


TRIM AUGMENTATION COMPUTER
PILOTS OVHD CB PANEL, CB1
AFCS NO. 1 SYS TRIM AGMT AC
AFCS NO. 2 SYS TRIM AGMT AC
AFCS NO. 1 SYS TRIM AGMT DC
AFCS NO. 2 SYS TRIM AGMT DC
AFCS FCES COMP DC
FE/SO AFT CB PANEL, CB3
IND LT FLT CONT ALT ALERT
IND LT PFCS ADS ON
FE/SO OVHD CB PANEL, CB2
5 VAC PANEL LIGHTING OVERHEAD L CTR
SYS 1 POWER SUPPLY
SYS 2 POWER SUPPLY
POWER SUPPLY MON 1A
POWER SUPPLY 1B
POWER SUPPLY MON 2A
POWER SUPPLY MON 2B
STAB AP CONT SERVO
PITCH TRIM AND FEEL ASSY
AFCS/MLG ACCESSORY UNIT
NORM ACCELLOMETER UNIT (TRIPLE)
FCES COMPUTER
IND LTS CONT BOX
FCES CONTROL PANEL
FLT CONTROL PANEL
SURFACE POSITION INDICATOR
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
SPEED CONTROL COMPUTER
NOTE
WM DIA CROSS REF.
WM DIA CROSS REF.

R Trim Augmentation Computer Power Distribution Schematic
R SCHEM 1

EFFECTIVITY: ALL

001B



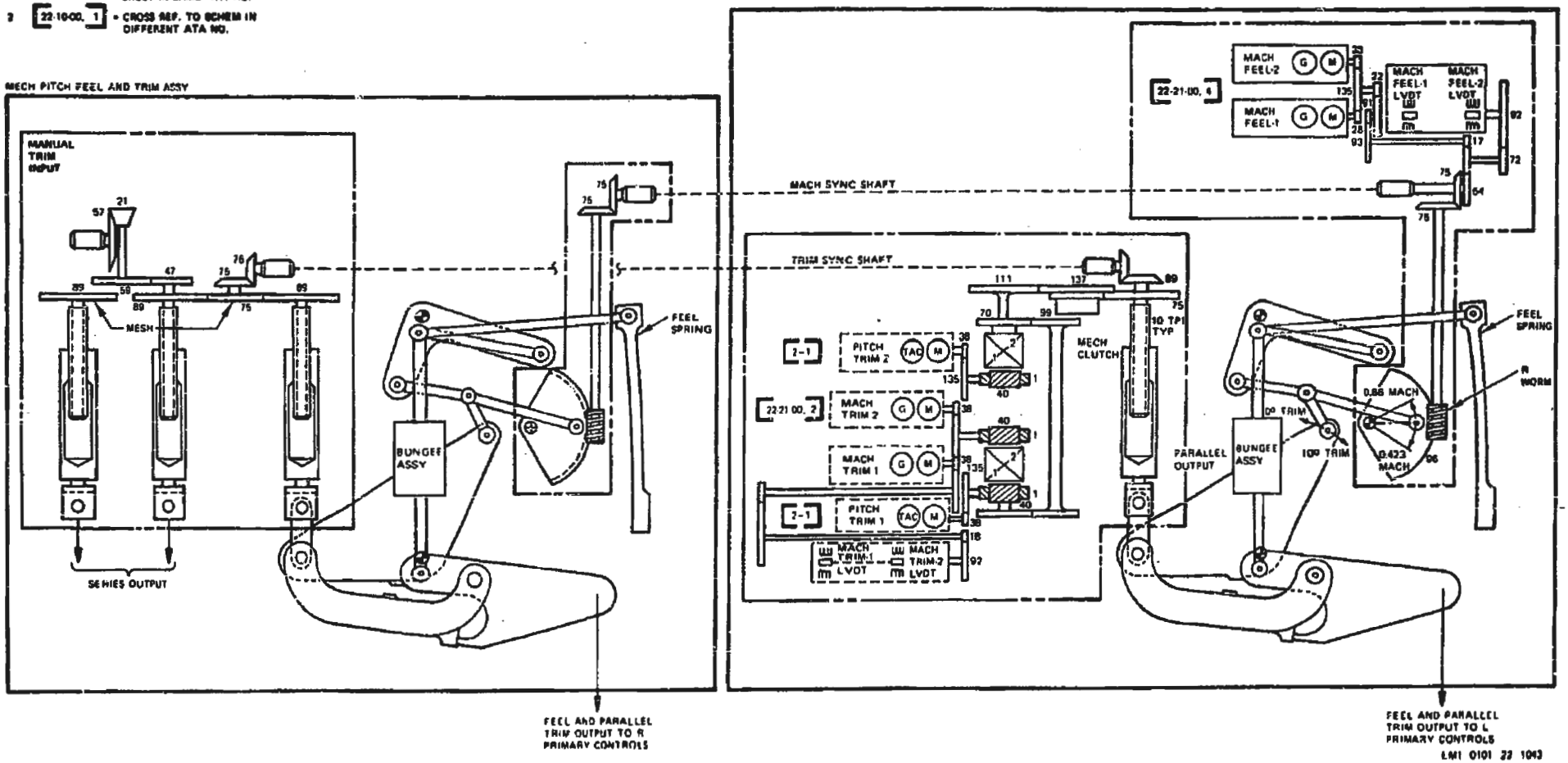
Pitch Trim Signal Flow Schematic
SCHEM 2 (Sheet 1)

EFFECTIVITY: ALL

NOTE

1 [:-1] • CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

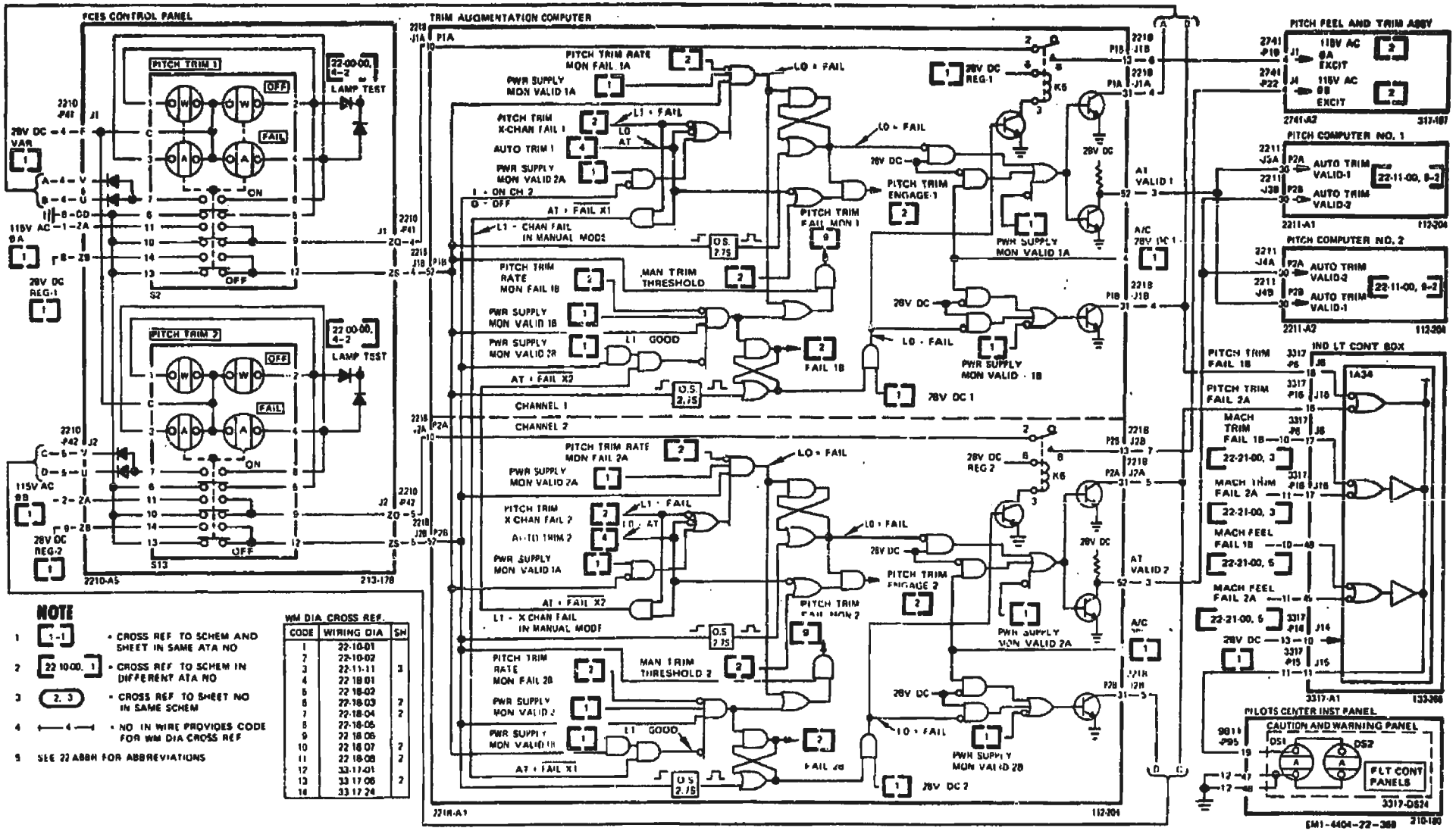
2 [22-1000, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.



R Pitch Trim Signal Flow Schematic
R SCHEM 2 (Sheet 2)

EFFECTIVITY: ALL

0018



NOTE

1. [1-1] • CROSS REF TO SCHEM AND SHEET IN SAME ATA NO
2. [22 10-00, 1] • CROSS REF TO SCHEM IN DIFFERENT ATA NO
3. (2, 3) • CROSS REF TO SHEET NO IN SAME SCHEM
4. —4— • NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5. SEE 22 ABBR FOR ABBREVIATIONS

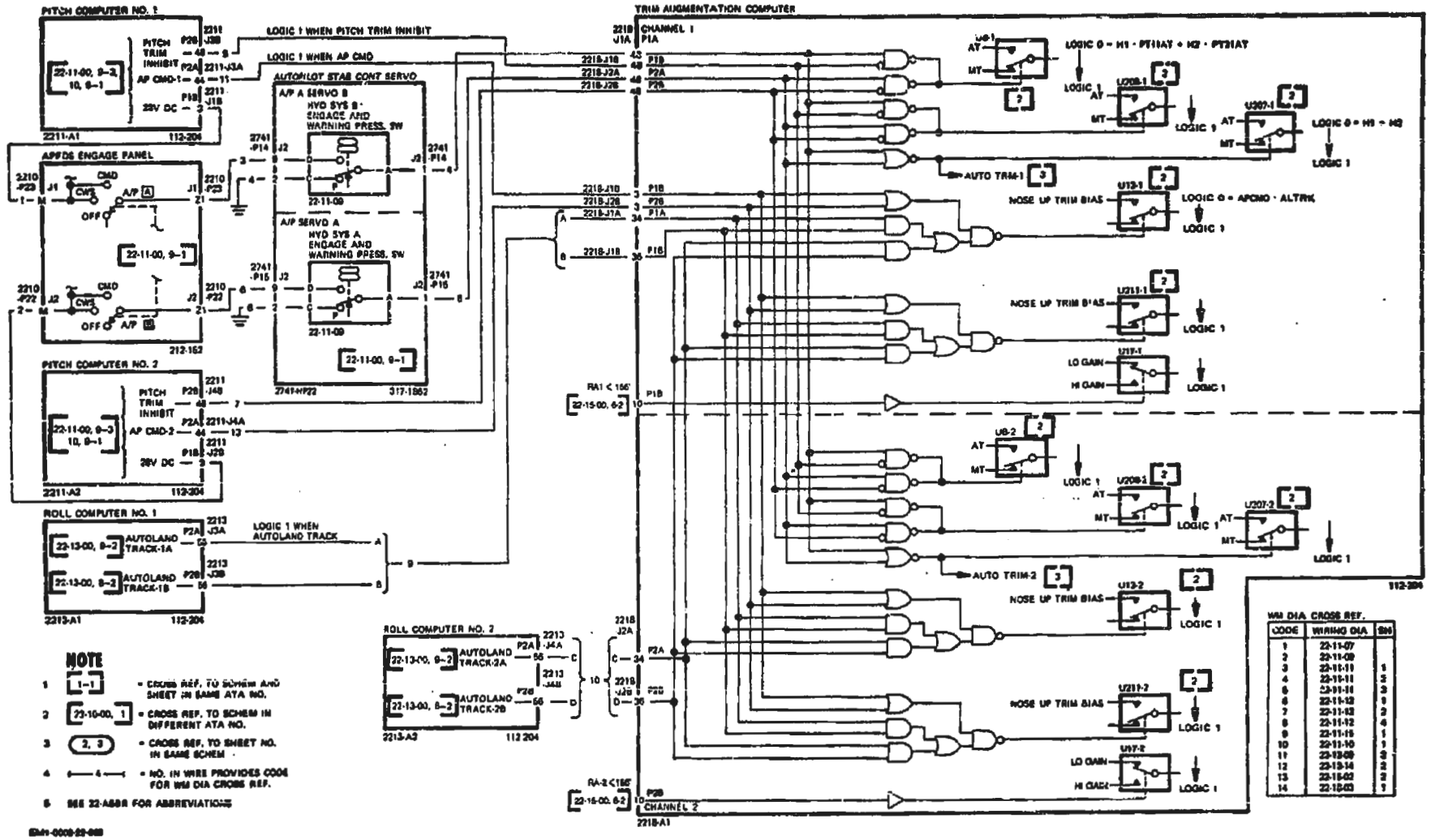
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-10-01	
2	22-10-02	
3	22-11-11	3
4	22 18 01	
5	22 18-02	
6	22-18-03	2
7	22-18-04	2
8	22-18-05	
9	22 18 06	
10	22 18 07	2
11	22 18-08	2
12	33-17-01	
13	33 17 06	2
14	33 17 24	

R Pitch Trim Engage/Fail Logic Schematic
R SCHEM 3

EFFECTIVITY: ALL

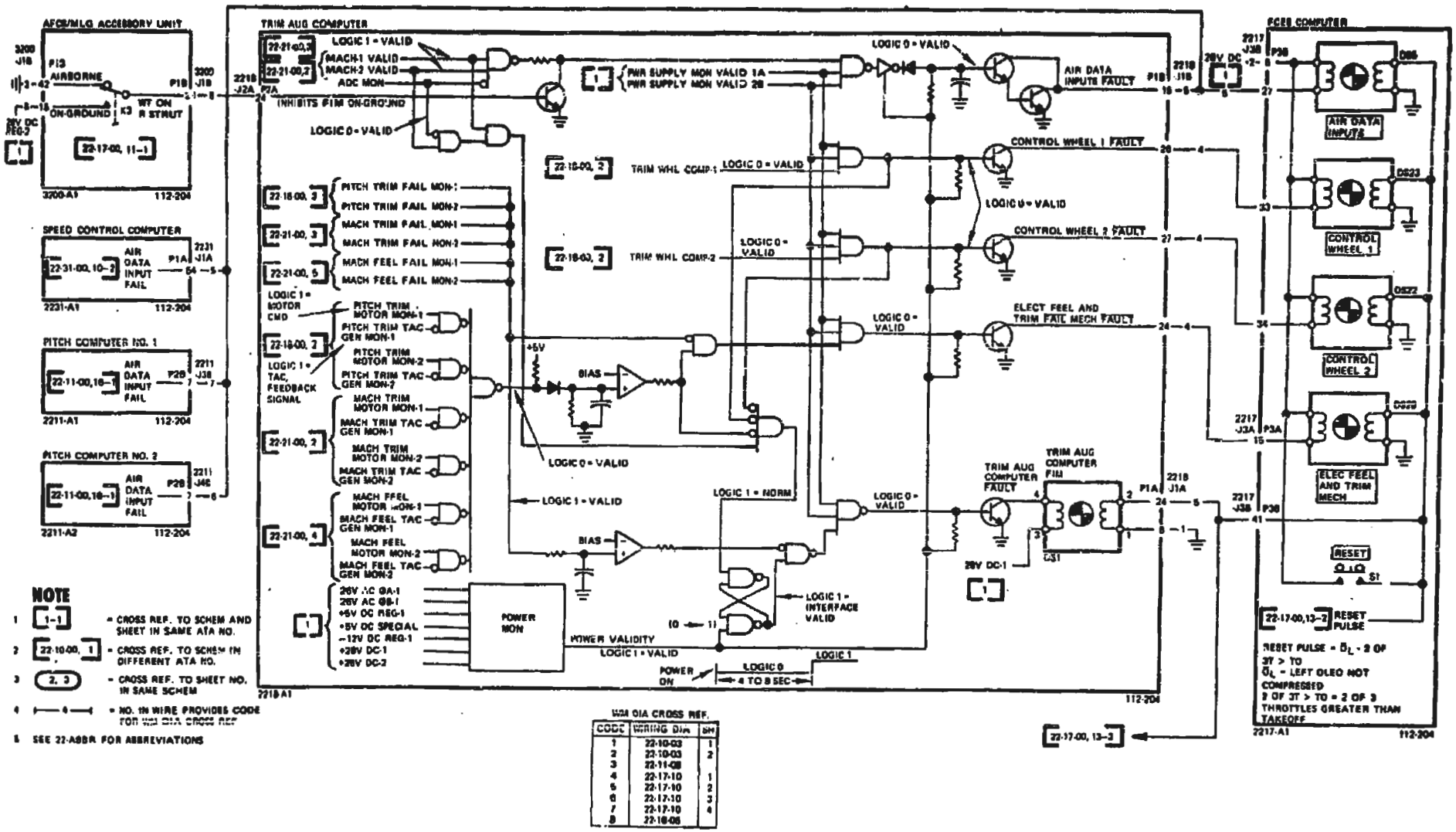
001B



Pitch Trim Switching Logic Schematic
SCHEM 4

EFFECTIVITY: ALL

001B


AFCS/MLG ACCESSORY UNIT
TRIM AUG COMPUTER
FCES COMPUTER
SPEED CONTROL COMPUTER
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
AIRBORNE
ON-GROUND
WT ON R STRUT
LOGIC 1 = VALID
MACH 1 VALID
MACH 2 VALID
ADC MON
INHIBITS FIM ON-GROUND
LOGIC 0 = VALID
PWR SUPPLY MON VALID 1A
PWR SUPPLY MON VALID 2B
AIR DATA INPUTS FAULT
TRIM WHL COMP-1
TRIM WHL COMP-2
CONTROL WHEEL 1 FAULT
CONTROL WHEEL 2 FAULT
ELECT FEEL AND TRIM FAIL MECH FAULT
PITCH TRIM FAIL MON-1
PITCH TRIM FAIL MON-2
MACH TRIM FAIL MON-1
MACH TRIM FAIL MON-2
MACH FEEL FAIL MON-1
MACH FEEL FAIL MON-2
LOGIC 1 = MOTOR CMD
LOGIC 1 = TAC FEEDBACK SIGNAL
PITCH TRIM MOTOR MON-1
PITCH TRIM TAC GEN MON-1
PITCH TRIM MOTOR MON-2
PITCH TRIM TAC GEN MON-2
MACH TRIM MOTOR MON-1
MACH TRIM TAC GEN MON-1
MACH TRIM MOTOR MON-2
MACH TRIM TAC GEN MON-2
MACH FEEL MOTOR MON-1
MACH FEEL TAC GEN MON-1
MACH FEEL MOTOR MON-2
MACH FEEL TAC GEN MON-2
+5V
BIAS
LOGIC 1 = NORM
LOGIC 1 = INTERFACE VALID
POWER VALIDITY
LOGIC 1 = VALID
POWER ON
LOGIC 0
LOGIC 1
4 TO 8 SEC
TRIM AUG COMPUTER FAULT
TRIM AUG COMPUTER FIM
AIR DATA INPUTS
CONTROL WHEEL 1
CONTROL WHEEL 2
ELEC FEEL AND TRIM MECH
RESET
RESET PULSE
RESET PULSE = $\bar{O}_L$ - 2 OF 3T > TO
$\bar{O}_L$ = LEFT OLEO NOT COMPRESSED
2 OF 3T > TO = 2 OF 3 THROTTLES GREATER THAN TAKEOFF
NOTE
1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— = NO. IN WIRE PROVIDES CODE FOR WIRE DATA CROSS REF
5 SEE 22-ABBR FOR ABBREVIATIONS
WIRE DATA CROSS REF.
CODE | WIRING DIAG | SHT
1 | 22-10-03 | 1
2 | 22-10-03 | 2
3 | 22-11-08 | 1
4 | 22-17-10 | 1
5 | 22-17-10 | 2
6 | 22-17-10 | 3
7 | 22-17-10 | 4
8 | 22-18-05 | 1

EM1-2004-22-288

R Trim Augmentation Computer FIM Schematic
R SCHEM 5

EFFECTIVITY: ALL

001B

TRIM AUGMENTATION SYSTEM - ADJUSTMENT AND TEST

1. General

The trim augmentation system adjustment and test consists of a pitch trim system test. For adjustment and test of Mach feel and trim systems, refer to 22-21-00. The adjustment and test requires that all other autoflight system components and associated equipment are installed and operational.

2. Referenced Procedures

21-25-00	Electronics and Electrical Service Center Exhaust System - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
34-21-00	Attitude Reference System - Maintenance Practices
34-22-00	Magnetic Heading References System - Maintenance Practice

3. Adjustment/Test - Pitch Trim System

A. Preparation

R (1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS - PITCH & ROLL (A6)

TRIM AGMT AC (A7)

TRIM AGMT DC (A8)

AFCS MODE IND (B1)

NO. 2 SYSTEMS - PITCH & ROLL (A24)

TRIM AGMT AC (A25)

TRIM AGMT DC (A26)

AFCS MODE IND (B19)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215 verify that following circuit breakers are closed:

AFCS WARNING

CAPT (K18)

F/O (K19)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that following circuit breakers are closed:

IND LT

PFCS ADS/DH (G8)

FLT CONT ALT ALERT (G9)

(4) Verify that trim augmentation computer FIM annunciator is black, and that pitch trim annunciators (CONTROL WHEEL 1 and 2, ELEC FEEL & TRIM MECH) on FCES computer are black.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(5) Turn on hydraulic systems A, B, and C (Ref. 29-11-00).

(6) Verify that following systems are on:

Attitude reference system (Ref. 34-21-00).

Magnetic heading reference system (Ref. 34-22-00).

(7) On FCES control panel, depress PITCH TRIM 1 and 2 switch lights to on.

(8) On center console, set manual TRIM WHEEL to an index of approximately 5.0.

(9) Set flaps to greater than 30 degrees.

B. Manual Pitch Trim Operational Test

(1) On Capt control wheel, rotate pitch trim thumbwheel for nose-up trim. Trim wheels in center console rotate for nose-up trim and control columns move aft.

(2) On F/O control wheel, rotate pitch trim thumbwheel for nose-down trim. Trim wheels in center console rotate for nose-down trim and control columns move forward.

R (3) On center console, set manual TRIM WHEEL to an index of approximately 5.0.

C. Auto Pitch Trim Operational Test

(1) On CB1, open PITCH & ROLL (A24) circuit breaker.

(2) On APFDS ENGAGE panel, set AP engage switch A to CWS. On both AFCS WARNING indicators, AP LIMIT messages are not displayed. Control columns and wheels remain in previously established position.

(3) On FCES panel, depress PITCH TRIM 2 switchlight to OFF. AP engage switch A remains in CWS.

(4) In FESC, remove AFCS/MLG accessory unit.

WARNING: IF TEST IS INTERRUPTED FOR ANY REASON INSTALL AFCS/MLG ACCESSORY UNIT BEFORE DISCONTINUING TEST.

WARNING: DO NOT ENGAGE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(5) Set AP engage switch A to CMD.

(6) On HEADING/PITCH MODE panel, depress VS switchlight to on. On Capt AFCS MODES annunciator, VS message is displayed. AP engage switch A remains in CMD.

C NOTE: Flaps must be set to 33° to ensure A/P limit
C annunciation.

(7) On HEADING/PITCH MODE panel, set VERT SPEED thumbwheel for a plus 200 (blue background) indication. AP engage switch A remains in CMD. Control columns move aft and stop. On center pedestal, pitch trim wheels rotate in nose-up direction and stop. On both AFCS WARNING

indicators, AP LIMIT messages and flashing ALERT lights are displayed after a short time interval.

(8) On FCES panel, depress PITCH TRIM 1 switchlight to OFF. AP engage switch A drops to OFF. On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed. Aural warning sounds.

(9) Depress PITCH TRIM 1 switchlight to on.

(10) On center console, set manual TRIM WHEEL to an index setting of 5.05.

(11) Set AP engage switch A to CWS. On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are removed.

(12) On Capt control wheel, rotate pitch trim thumbwheel for nose-up trim. Pitch trim wheels do not rotate.

(13) On Capt control wheel, pull aft slightly (approximately 3 inches) and simultaneously rotate pitch trim thumbwheel for noseup trim. Pitch trim wheels rotate.

(14) Release control wheel force.

(15) On Capt control wheel, depress AP DISC switch. AP engage switch A drops to OFF. On both AFCS WARNING indicators, AP DISC messages are displayed with flashing ALERT lights. Aural warning sounds.

(16) In FESC install AFCS/MLG accessory unit.

(17) On center console set manual TRIM WHEEL to an index of approximately 5.0.

(18) On CB1, close PITCH & ROLL (A24) circuit breaker, and open PITCH & ROLL (A6) circuit breaker.

(19) Depress PITCH TRIM 2 switchlight to on.

(20) On APFDS ENGAGE panel, set AP engage switch B to CWS. On both AFCS warning indicators, AP LIMIT messages are not displayed. Control columns and wheels remain in previously established position.

(21) On FCES panel, depress PITCH TRIM 1 switchlight to OFF. AP engage switch B remains in CWS.

(22) In FESC, remove AFCS/MLG accessory unit.

(23) Set AP engage switch B to CMD.

(24) Depress VS switchlight to on. On F/O AFCS MODES annunciator, VS message is displayed. AP engage switch B remains in CMD.

(25) Set VERT SPEED thumbwheel for a plus 200 (blue background) indication. AP engage switch B remains in CMD. Control columns move aft and stop. On center pedestal, pitch trim wheels rotate in nose-up direction and stop. On both AFCS WARNING indicators, AP LIMIT messages and flashing ALERT lights are displayed after a short time interval.

C C NOTE: Flaps must be set to 33° to ensure A/P limit annunciation.

(26) On FCES panel, depress PITCH TRIM 2 switchlight to OFF. AP engage switch B drops to OFF. On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are displayed. Aural warning sounds.

(27) Depress PITCH TRIM 2 switchlight to on.

(28) On center console, set manual TRIM WHEEL to an index setting of 5.05.

(29) Set AP engage switch B to CWS. On both AFCS WARNING indicators, AP DISC messages and flashing ALERT lights are removed.

(30) On F/O control wheel, rotate pitch trim thumbwheel for nose-up trim. Pitch trim wheels do not rotate.

R (31) On F/O control wheel, pull aft slightly (approximately 3 inches) and simultaneously rotate pitch trim thumbwheel for nose-up trim. Pitch trim wheels rotate.

(32) Release control wheel force.

(33) On F/O control wheel, depress AP DISC switch. AP engage switch B drops to OFF. On both AFCS WARNING indicators, AP DISC messages are displayed with flashing ALERT lights. Aural warning sounds.

(34) On F/O control wheel, depress AP DISC switch to remove AFCS WARNING indications.

(35) On CB1, close A6 circuit breaker.

(36) Depress PITCH TRIM 1 switchlight to on.

D. Completion

(1) In FESC, install AFCS/MLG accessory unit.

(2) Check computer verification as follows:

(a) Verify that trim augmentation computer FIM annunciator is black.

(b) Verify that all pitch trim FIM annunciators (CONTROL WHEEL 1 and 2, ELEC FEEL & TRIM MECH) on FCES computer are black.

(3) Turn off hydraulic power (Ref. 29-11-00).

(4) Turn off electrical power (Ref. 24-00-00).

TRIM AUGMENTATION COMPUTER - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 29-11-00 Hydraulic Power System - Maintenance Practices

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

R NO. 1 SYSTEMS - TRIM AGMT - AC (A7)

R NO. 1 SYSTEMS - TRIM AGMT - DC (A8)

R NO. 2 SYSTEMS - TRIM AGMT - AC (A25)

R NO. 2 SYSTEMS - TRIM AGMT - DC (A26)

(2) Open access door 112AB and enter forward electronic service center, zone 112. Locate trim augmentation computer in center rack (Ref. Fig. 401).

(3) Release holddowns on computer front panel.

(4) Pull computer handle to release computer electrical connectors from mount connectors.

(5) Slide computer out of mount.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Slide trim augmentation computer (Ref. Fig. 401) into mount until computer electrical connectors mate with mount connectors.

(3) Secure computer with holddowns.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

R (6) Perform operational test in Step C.

R C. Operational Test

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY
R HYDRAULIC SYSTEM:

R LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY
R OEVICES ARE INSTALLED.

R TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND
R MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND
R EQUIPMENT.

R THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT
R HYDRAULIC PRESSURE.

R (1) Turn on hydraulic systems A, B, C and D (Reference
R 29-11-00).

R (2) On FCES panel, depress PITCH TRIM 1 and 2 switchlights
R to OFF, then on.

R RESULT:

R OFF lights come on in OFF position, and
R switchlights are dark in on position.

R (3) On FCES panel, depress MACH TRIM 1 and 2 switchlights
R to OFF, then on.

R RESULT:

R OFF lights come on in OFF position, and
R switchlights are dark in on position.

R NOTE: It may be necessary to cycle MACH TRIM
R and/or MACH FEEL switchlights several times
R to turn off FAIL annunciations that may
R have been tripped by previous operations or
R unit changes.

R (4) On Flight Control panel depress MACH FEEL 1 and 2
R switchlights to OFF, then on.

R RESULT:

R OFF lights come on in OFF position, and
R switchlights are dark in on position.

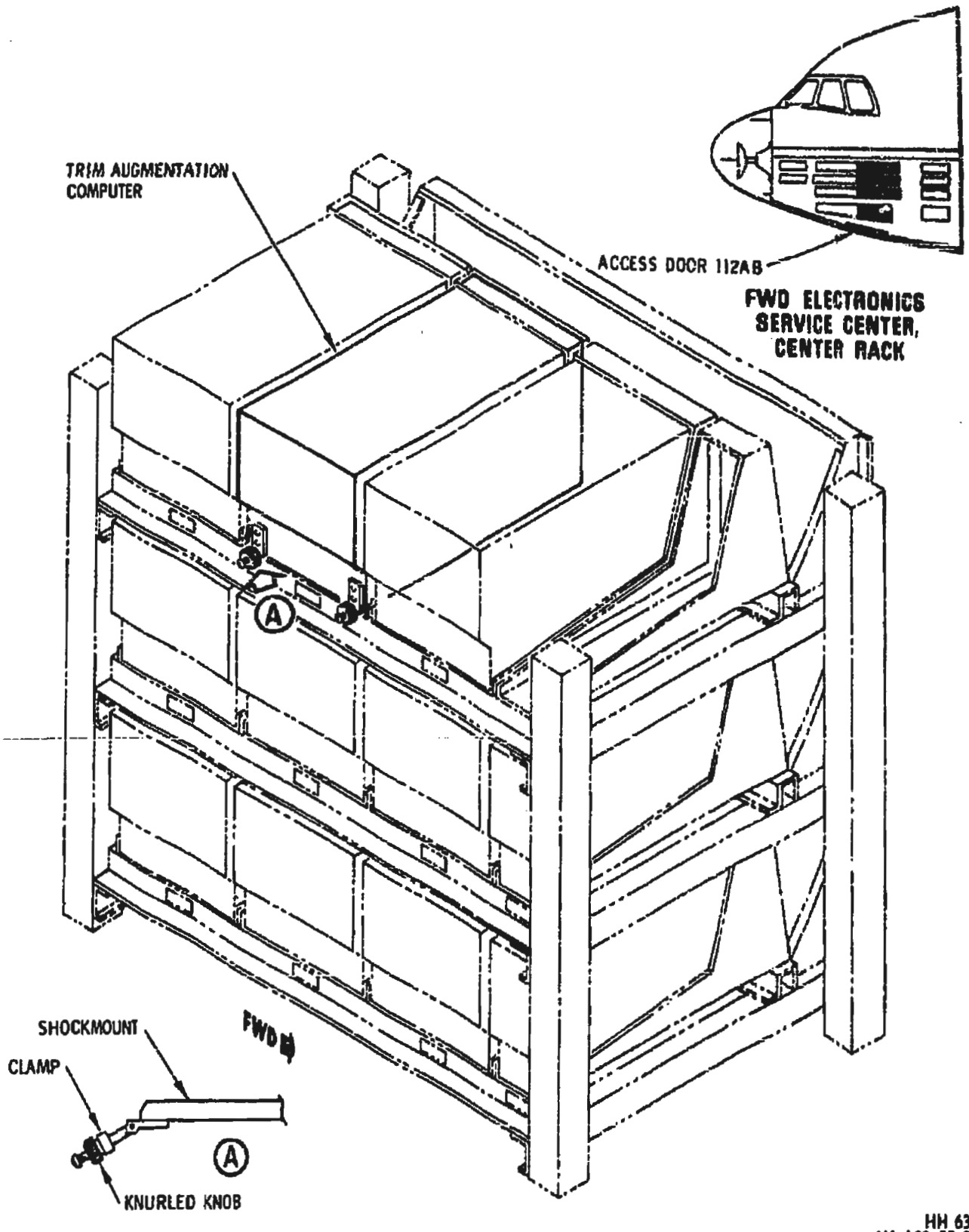
R (5) On Captains control wheel, turn pitch trim thumbwheel
R in both directions.

R RESULT:

R Control column moves in both directions with no
R PITCH TRIM FAIL light.

R (6) Repeat Step (5) using First Officers pitch trim
R thumbwheel.

R (7) Turn off hydraulic system.



Trim Augmentation Computer - Removal and Installation
Figure 401

ELECTRIC TRIM MOTOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, MS20995C20, or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels
R	21-25-00	Electronic and Electrical Service Centers Exhaust
R		Systems - Adjustment and Test
	24-41-00	External Power/Ground Service System - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL SYSTEM - NO.1 SYSTEMS - TRIM AGMT - AC (A7) and NO.2 SYSTEMS - TRIM AGMT - AC (A25).

(2) Open access door 3178B (Ref. 6-40-00).

(3) Remove electrical trim actuator assembly cover by removing screws and washers (Ref. Fig. 401).

(4) Remove nuts attaching electrical connector to electric trim motor.

(5) Remove connector from motor and set aside.

(6) Remove motor-mounting screws. Lift motor clear of mounting plate.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Position motor (Ref. Fig. 401) on mounting plate, ensuring proper mesh of motor gear.

(3) Attach motor to mounting plate with screws. Torque
R screws 5 to 10 lb in. Lock-wire screws using
R single-wire method.

(4) Install electrical connector on motor.

(5) Secure connector with nuts. Torque nuts 1 to 2 lb in.

(6) Install assembly cover with washers and screws. Torque
R screws 15 to 20 lb in. Lock-wire screws using
R single-wire method.

(7) Remove tags and close circuit breakers opened in Step 3A(1).

(8) Turn on electrical power (Ref. 24-41-00).

(9) Verify that avionics cooling is on (Ref. 21-25-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM.

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(10) Turn on one of hydraulic power systems (Ref. 29-11-00).

(11) On FCES control panel, zone 210, turn off pitch trim system as follows:

(a) For electric trim motor No. 1 installation, release (out) PITCH TRIM 2 switchlight.

(b) For electric trim motor No. 2 installation, release PITCH TRIM 1 switchlight.

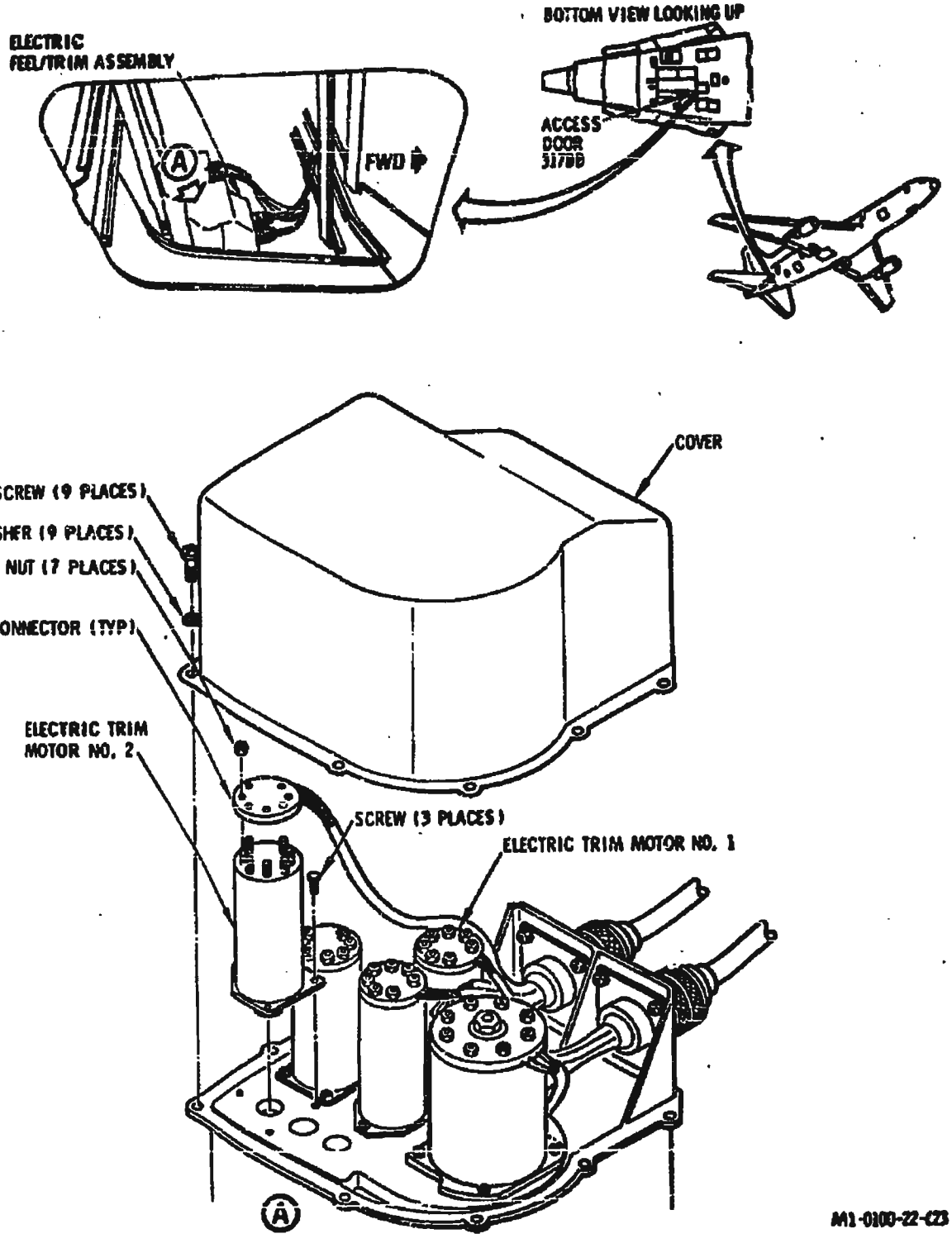
(12) On either control wheel, rotate pitch trim wheel. Verify small control column displacement.

(13) Depress (latch in) PITCH TRIM switchlight released in Step 3B(11) to on.

(14) Turn off hydraulic power (Ref. 29-11-00).

(15) Turn off electrical power (Ref. 24-41-00).

(16) Close access door 317BB.



R Electric Trim Motor - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

R # SPEED ATTITUDE CORRECTION - DESCRIPTION AND OPERATION

R 1. General

R Speed attitude correction of the aircraft is accomplished by two
R systems: The Mach Trim System and the Mach Feel System.
R Undesirable effects upon the attitude of the aircraft due to
R speed are overcome by the Mach Trim System, which moves the
R stabilizer a predetermined amount as a function of Mach number.
R The Mach Feel System varies the spring tension reflected in the
R control wheel a predetermined amount as a function of Mach
R number. Each system utilizes separate and independent circuits,
R separate controls, and separate electric motors. Both systems
R are discussed in the following section:

R 22-21-00 Mach Trim and Feel Systems

MACH TRIM AND FEEL SYSTEMS - DESCRIPTION AND OPERATION

1. General

The Mach Trim and Feel Systems are incorporated in the aircraft to improve attitude control which is affected by speed. The Mach Trim system automatically varies the stabilizer as the speed of the aircraft is changed. This is done to compensate for the tuck (nose-down) tendency of the aircraft as speed is increased (between Mach 0.55 and 0.95). The Mach Feel System automatically varies the force on the pitch feel/trim system feel spring as the speed of the aircraft is changed. This force is reflected back to the control wheel. The more Mach trim that is applied to the stabilizer, the more force that is required to operate the control wheel.

The Mach Trim System consists of the following major components:

Trim Augmentation Computer

FCES Control Panel

Mach Trim Motor No. 1

Mach Trim Motor No. 2

The Mach Feel System consists of the following major components:

Trim Augmentation Computer

Flight Control Panel

Mach Feel Motor No. 1

Mach Feel Motor No. 2

2. Mach Trim System

A. General

R The Mach Trim System automatically compensates for undesireable speed effects on the attitude of the aircraft through electromechanical system. The electrical/electronic circuits monitor speed functions which are used to direct the operation of electronic motors. These Mach trim motors in turn drive mechanical gears and linkages which control a servo system that operates the horizontal stabilizer. Mach trim system equipment and location is shown in Figure 1.

B. Operation

The functional signal flow of the Mach Trim system is shown in Figure 2.

(1) Mach Trim Power Application

The Mach trim system receives power from the aircraft electrical system buses (Ref. 24-00-00) through the pilots overhead circuit breaker panel. All system circuit breakers are located in the areas designated AVIONICS FLIGHT CONTROL SYSTEM on the circuit breaker panel.

R The TRIM AGMT AC (NO. 1 SYSTEM) (CB1-A7) circuit breaker on the 115V, 400 Hz, Phase A essential bus
R distributes power to channel 1 of the trim augmentation computer and the FCES control panel. The TRIM AGMT AC (NO. 2 SYSTEM) (CB1-A25) circuit breaker on the 115V, 400 Hz, Phase B extension bus 2 supplies power to channel 2 of the computer and control panels.

The power to each computer channel is processed by the computer channel power supply to produce the operating voltages for the channel. The voltages to the FCES control panel are switched and applied to the Mach trim motors through the computer.

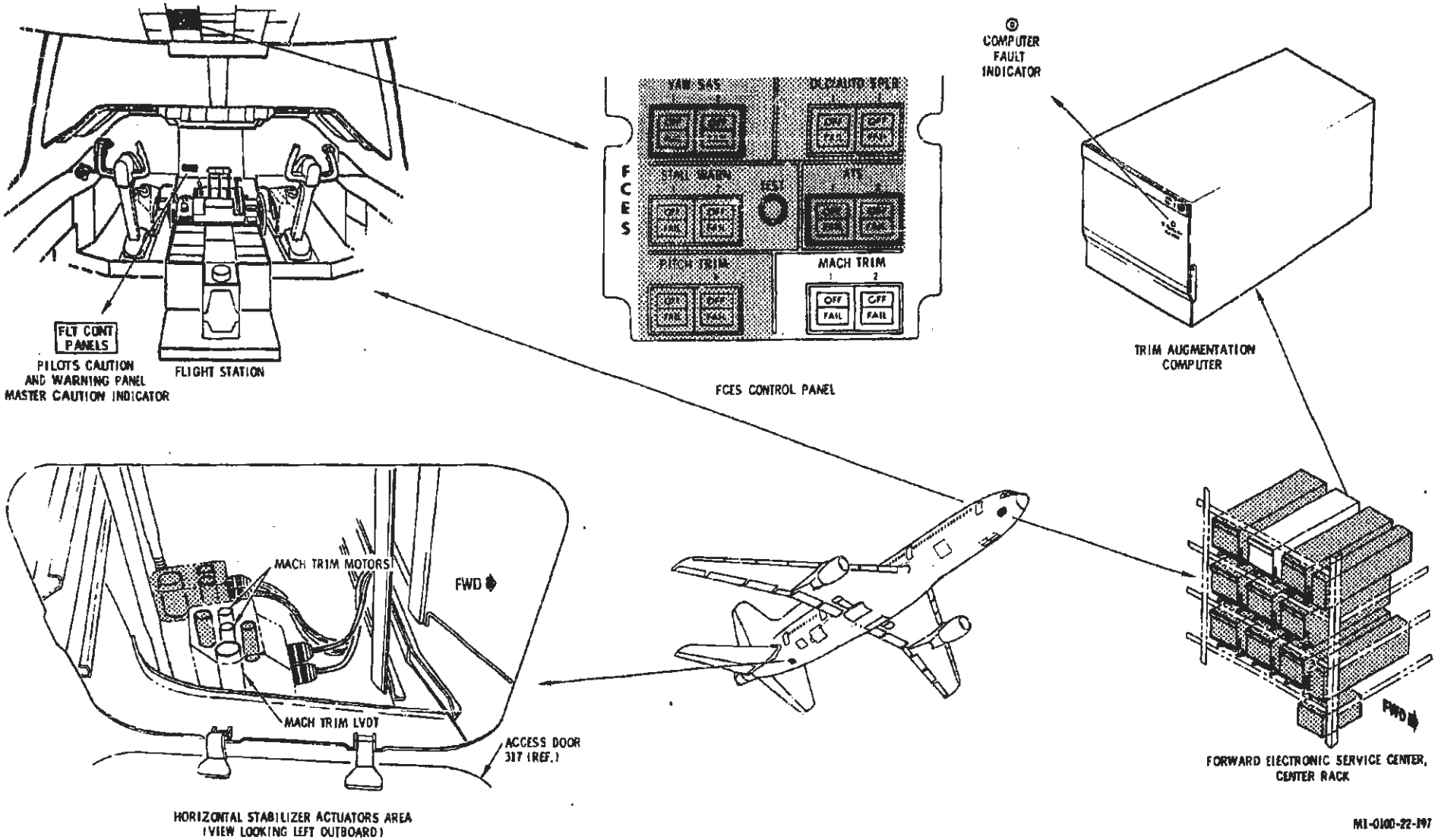
The TRIM AGMT DC (NO. 1 SYSTEM) (CB1-A8) circuit breaker on the 28 VDC essential bus distributes power to channel 1 of the trim augmentation computer and to Mach trim motor No. 1 through the computer.

The TRIM AGMT DC (NO. 2 SYSTEM) (CB1-A26) circuit breaker on the 28 VDC No. 2 bus provides power to computer channel 2, and to Mach trim motor No. 2 through the computer.

(2) Mach Trim Engagement

The two Mach trim channels are independently engaged through the MACH TRIM switchlights on the FCES control panel. When power is applied to the aircraft, 28 VDC from the trim augmentation computer channel power supplies are applied to the switchlights on the FCES control panel. The normally depressed (latched in) switchlights return channel-on signal to the engage logic circuit of the respective Mach trim channels in the computer.

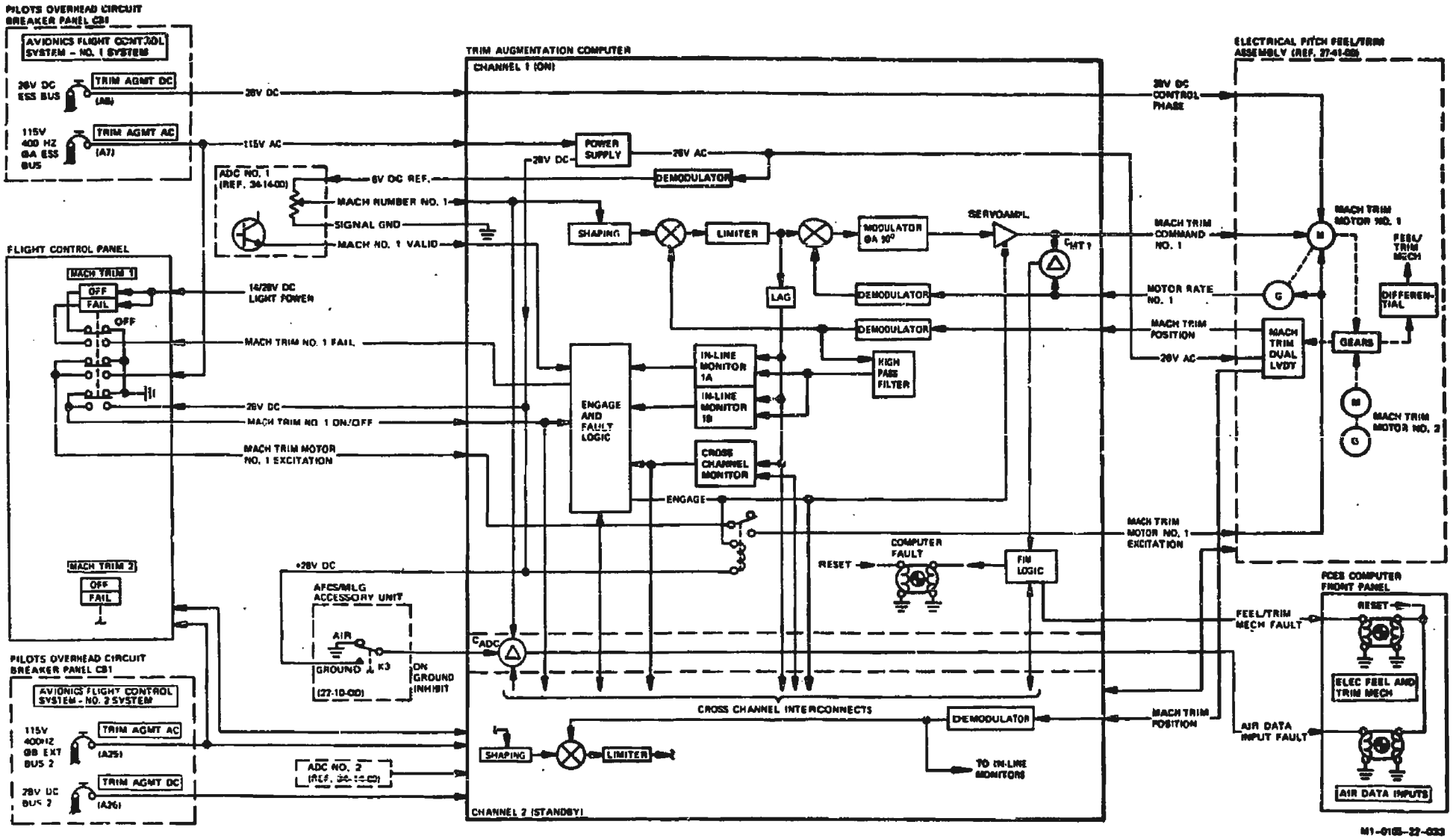
Although both Mach trim channels are engaged, the second channel is inhibited and only channel 1 provides



R Mach Trim System Equipment and Location
R Figure 1

EFFECTIVITY: ALL

001R



R Mach Trim System Functional Block Diagram
R Figure 2

EFFECTIVITY: ALL

001B

R the command output signal. Channel 2 remains in
R standby, and is automatically enabled if a failure
R occurs in channel 1.

R With both channels operational, one channel can be used
R by disengaging the other. The normally operating
R channel 1 can be disengaged through the associated
R switchlight which automatically enables channel 2.
R Reengagement of channel 1 automatically inhibits
R channel 2. When a channel is disengaged by the
R switchlight, the OFF message on the switchlight comes
R on.

R (3) Mach Trim Command

R Each Mach trim channel in the trim augmentation
R computer receives a Mach number signal from the
R associated air data computer (Ref. 34-14-00). This
R signal is varied by the ADC as the speed in MACH number
R of the aircraft varies. The Mach number input signal
R is shaped and limited by the computer and then applied
R to the servo amplifier circuits to drive the Mach trim
R motor in the left electrical trim and feel assembly.

R The output shaft of the Mach trim motor is coupled
R through gears to differentials where any manual
R electrical pitch trim output is summed. The output of
R the differentials drives the pitch feel/trim mechanisms
R (Ref. 27-41-00). The mechanisms, in turn, drive the
R stabilizer and control columns through the flight
R control linkage to a position proportional to the Mach
R input.

R In addition to driving the differentials, the Mach trim
R motor drives a rate generator and a linear variable
R differential transformer (LVDT). The output signal of
R the rate generator is proportional to the speed of the
R Mach trim motor, and is fed back and summed into the
R Mach trim input circuit. This feedback signal provides
R damping of the system by reducing the effect of the
R trim command signal. This in turn dampens the movement
R of the horizontal stabilizer so that it does not
R overshoot the desired position. The LVDT generates a
R signal which indicates the position of the horizontal
R stabilizer that the Mach trim motor has commanded.
R This LVDT signal is fed back and summed into the Mach
R trim input circuit. The purpose of this feedback
R signal is to assure that the system stops at the
R position commanded by the Mach trim signal input
R circuit.

R (4) Mach Trim In-Line Monitor

R Channel engagement requires the presence of the Mach
R valid signal from the associated air data computer and
R the channel-on signal from the FCES control panel. An
R in-line monitor in each Mach trim channel also
R continuously monitors the Mach trim operation. If the
R Mach valid or channel-on signal is absent or if the
R monitor detects a failure, the related engage logic
R circuit automatically inhibits the trim command output
R signal. At the same time, the logic circuit provides a
R fail logic signal to the FCES control panel causing the
R FAIL message on the associated MACH TRIM switchlight to
R come on.

R (5) Mach Trim Cross-Channel Monitor

R A cross-channel monitor is also included in the
R computer to compare the trim command inputs to the
R servo loop of both Mach trim channels. The two signals
R must be compatible to within a preset threshold for
R both Mach trim channels to be operational. If the
R monitor detects a deviation above the preset threshold,
R the related logic circuit in both channels
R automatically inhibits the channels. At the same time,
R both channels provide a fail logic signal to the
R associated MACH TRIM switchlights causing the FAIL
R message to come on.

R (6) Mach Trim Fault Isolation Monitor

R A fault isolation monitor (FIM) is included in each
R channel of the trim augmentation computer for ground
R maintenance purposes. The FIM isolates a failure to a
R certain input, the computer, or the output of the Mach
R trim channel. A computer failure isolated by either
R FIM is indicated by the FIM annunciator on the computer
R front panel. In addition to computer failures, the
R FIMs isolate failures to the air data inputs or the
R electrical feel/trim mechanims. The monitoring FIM
R sends an annunciation logic signal (ground) to set the
R associated FIM annunciator on the FCES computer front
R panel. The annunciators on the FCES computer which
R apply to the Mach trim function are AIR DATA INPUTS and
R ELEC FEEL & TRIM MECH.

R C. Trim Augmentation Computer

R The Trim augmentation computer is located in the forward
R electronic service center, center rack (Ref. Fig. 1).
R Aircraft AC and DC power are fed to the computer, which
R processes this power to energize various components of the
R Mach trim system such as computer power supplies, control
R circuits, motor circuits, monitor circuits, and fault logic

circuits. The primary function of the computer Mach trim portion is to monitor the Mach number of the ADC and drive the Mach trim motors. In addition, the computer utilizes the monitor and fault logic circuits to compare the operation of the two ADC units and the two Mach trim channels. Should a failure occur, these circuits select the active channel or ADC, and indicate the failure on the FCES computer, the trim augmentation computer, and the FCES control panel. For a detailed description of the Trim Augmentation Computer, see Section 22-18-00.

D. FCES Control Panel

The FCES control panel is located on the pilots overhead control panel (Ref. Fig. 1). The FCES control panel contains the MACH TRIM 1 and 2 switchlights to monitor and control the Mach trim channels. The switchlights have FAIL-OFF legends. If failure is detected in a Mach trim channel, the associated FAIL message comes on. When the applicable switchlight is depressed, the FAIL message goes out and the OFF message comes on. The OFF message indicates that the failed channel is turned off. The switchlights also provide selective engagement and disengagement of the Mach trim channel. For a detailed description of the FCES Control Panel, see Section 22-10-00.

E. Mach Trim Motor

(1) Motor

There are two Mach trim motors located on the electrical pitch feel/trim assembly in the afterbody section (Ref. Fig. 1). The operation of the Mach trim motor is the same as the other servo motors in the trim system. A basic diagram of the motor is shown in
R Figure 3. It consists of a four-pole stator, two poles of which are energized by the 115 VAC, 400 Hz, phase A excitation winding, and two poles of the control
R winding energized by the dual servo amplifier output of
R the trim augmentation computer. The control winding consists of two interconnected windings, one for each pole, the centertap of which is connected to 28 VDC aircraft power. The two control winding poles are energized by 400 Hz signals from the two servo-amplifiers, each signal being 180° out of phase with each other. These 400 Hz voltage signals in conjunction with the 28 VDC voltage results in a push-pull amplifier circuit in the control windings. In addition, the excitation winding voltage is 90° out of phase with the control winding voltage. This results in a rotating field in the stator which contributes to rotation of the motor. The rotor

consists of short heavy conductors connected to end rings similar to a squirrel cage rotor winding. The stator poles induce voltages in the rotor, which in turn set up opposite magnetic fields to the stator. These induced rotor fields in conjunction with the rotating stator fields cause rotation of the rotor. Speed of the motor is controlled by controlling the amplitude of the control winding signals. The direction of rotation of the trim motor is accomplished
R by switching which reverses the input servoamplifier signals to the control winding.

(2) Mach Trim Rate Generator

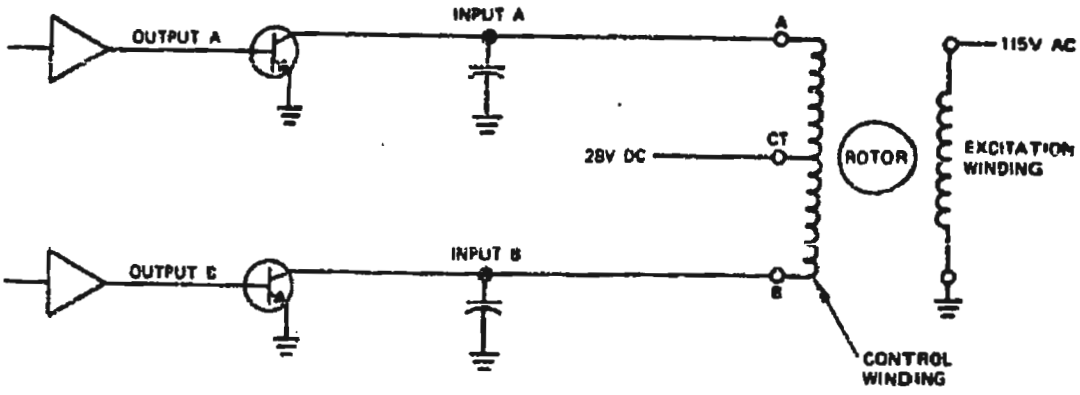
The Mach trim rate generator is located in the Electrical Pitch Feel/Trim assembly. It is contained in the same housing as the Mach trim motor. The rate generator is driven by the Mach trim motor and generates a voltage which is proportional to the speed of the Mach trim motor. This voltage is fed back in the servo loop and summed with the input Mach trim command signal. The effect of this feedback voltage is to dampen the operation of the Mach trim motor so that it does not overshoot the commanded position. For a detailed description of the Electrical Pitch Feel/Trim assembly on which the rate generator is located, see 27-41-00.

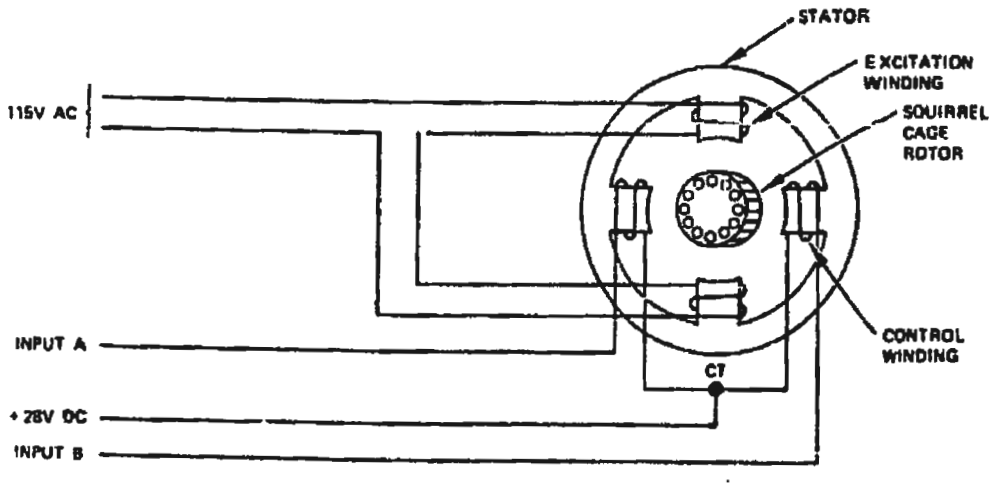
(3) Mach Trim LVDT

The Mach trim LVDT (linear variable differential transformer) is located in the Electrical Pitch Feel/Trim assembly. The LVDT is basically a transformer with a moveable core. The rotation of the Mach trim motor is converted into a linear movement which operates the LVDT core. Variation of the moveable core results in a variation of the output of the LVDT. The position of the moveable core and the consequent output voltage corresponds to the position of the stabilizer. The LVDT output signal is fed back in the servo loop and summed with the Mach trim input command signal. The effect of this feedback signal is to assure that the Mach trim motor stops at the position directed by the Mach trim command signal. For a detailed description of the Electrical Pitch Feel/Trim assembly on which the Mach trim LVDT is located, see 27-41-00.

F. Mach Trim System Interface

The Mach trim system interfaces with the following equipment:





EM1-0100-22-196

Trim Motor Diagram
Figure 3

R 34-14-00 Air Data Computer

R 22-10-00 AFCS/MLG Accessory Unit

R 27-41-00 Electrical Pitch Feel/Trim Assembly

R 22-17-00 FCES Computer

R (1) Air Data Computer (ADC)

R There are two air data computers located on the forward
R electronics service center rear rack, shelf 5, zone
R 113. Each ADC provides a valid signal and a signal
R proportional to the aircraft Mach number to the
R corresponding Mach trim system. The Mach number signal
R is derived from a potentiometer in the ADC which is
R excited by a reference signal from the trim
R augmentation computer. For a detailed description of
R the air data computer, see 34-14-00.

R (2) AFCS/MLG Accessory Unit

R The AFCS/MLG accessory unit is located in the forward
R electronics service center, center rack. The unit
R provides the trim augmentation computer a signal that
R indicates whether the aircraft is airborne or on the
R ground. The trim augmentation computer uses the signal
R to inhibit the AIR DATA INPUTS, fault FIM when the
R aircraft is on the ground. For a detailed description
R of the unit, see 22-10-00.

R (3) Electrical Pitch Feel/Trim Assembly (Left)

R The electrical pitch feel/trim assembly is located in
R the lower afterbody section, and is mounted just
R inboard of the left stabilizer servo module. The
R assembly receives and processes Mach trim electrical
R signals as well as all electrical trim (pilots
R thumbwheels), autopilot trim, and Mach feel. For a
R detailed description of the assembly, see 27-41-00.

R (4) FCES Computer

R The FCES computer is located on the forward electronics
R service center, center rack. The FCES computer front
R panel provides FIM indications for ELEC FEEL & TRIM
R MECH, and for AIR DATA INPUTS. For a detailed
R description of the FCES computer, see 22-17-00.

3. Mach Feel System

A. General

The Mach Feel System automatically varies the force of the pitch feel/trim system feel spring as the speed in Mach number of the aircraft varies. Control of the Mach feel
R system is accomplished by an electromechanical system. The electrical/electronic circuits monitor the same speed functions as the Mach trim system and utilize these functions to direct the operation of electric motors. These Mach feel motors in turn drive gears which operate the feel spring mechanism. The feel spring mechanism changes the force of the feel spring proportional to Mach number. This change in force is reflected back to the control wheel. Mach feel system equipment and location is shown in Figure 4.

B. Operation

The functional signal flow of the Mach feel system is shown in Figure 5.

(1) Mach Feel Power Application

R The Mach trim system receives power from the aircraft electrical system buses through the pilots overhead circuit breaker panel. All system circuit breakers are located in the areas designated AVIONICS FLIGHT CONTROL SYSTEM on the circuit breaker panel.

The TRIM AGMT AC (NO. 1 SYSTEM) (CB1-A7) circuit breaker on the 115V, 400 Hz, Phase A essential bus distributes power to channel 1 of the trim augmentation computer and the flight control panel. The TRIM AGMT AC (NO. 2 SYSTEM) (CB1-A25) circuit breaker on the 115V, 400 Hz, Phase B extension bus 2 supplies power to channel 2 of the computer and control panels.

The power to each computer channel is processed by the computer channel power supply to produce the operating voltages for the channel. The voltages to the flight control panel are switched and applied to the Mach feel motors through the computer.

The TRIM AGMT DC (NO. 1 SYSTEM) (CB1-A8) circuit breaker on the 28 VDC essential bus distributes power to channel 1 of the trim augmentation computer and to Mach feel motor No. 1 through the computer. The TRIM AGMT DC (NO. 2 SYSTEM) (CB1-A26) circuit breaker on the 28 VDC No. 2 bus provides power to computer channel 2, and to Mach feel motor No. 2 through the computer.

R (2) Mach Feel Engagement

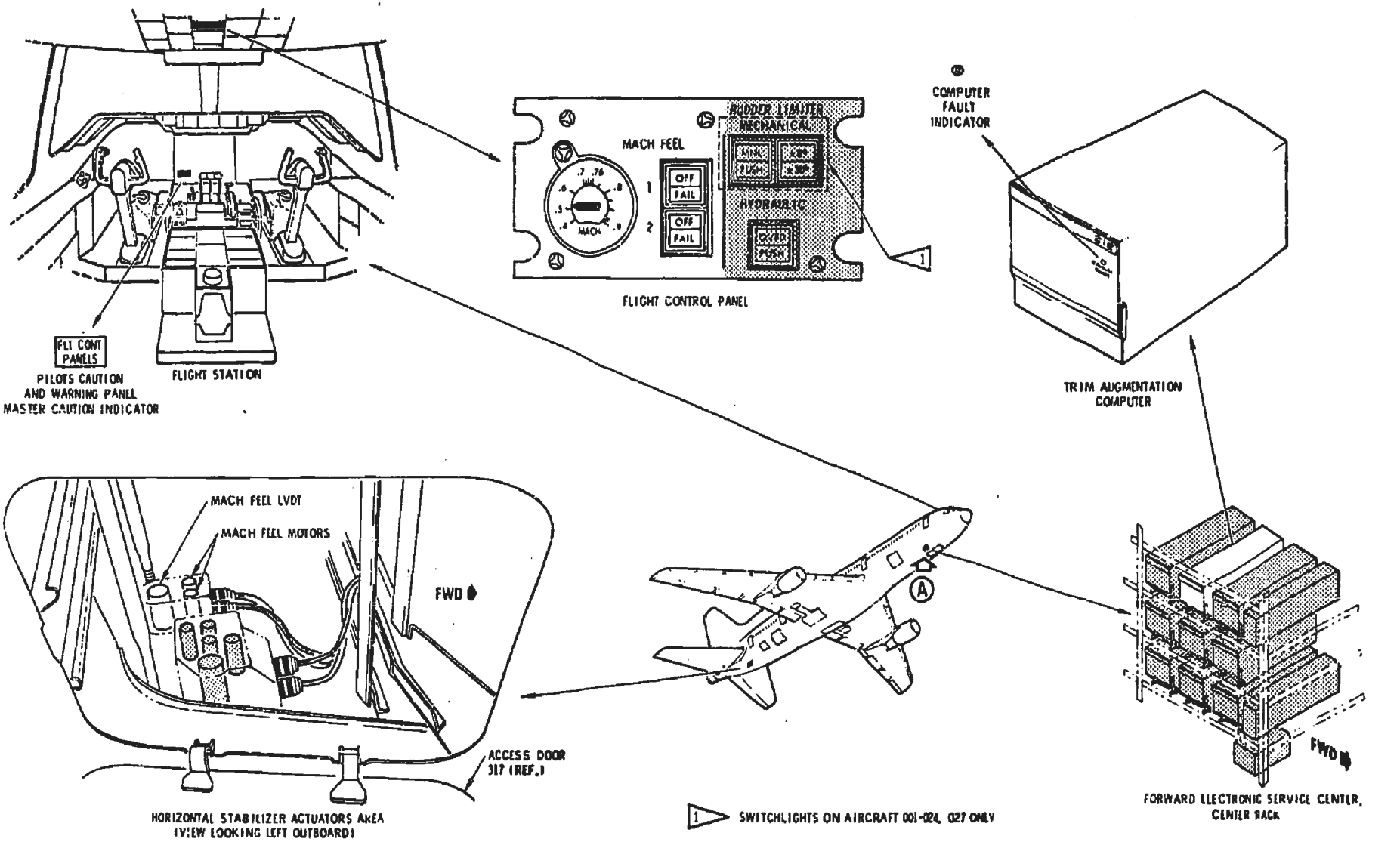
R The two Mach feel channels are independently engaged
R through the MACH FEEL switchlights on the flight
R control panel. When power is applied to the aircraft,
R 28 VDC from the trim augmentation computer channel
R power supplies is applied to the MACH FEEL
R switchlights. The normally depressed (latched in)
R switchlights return MACH feel dc-on (channel-on)
R signals to the engage logic circuits of the respective
R Mach feel channels in the computer.

R The switchlights also apply 115V ac 400 Hz Mach trim
R ac-on signals to the computer channels where the
R signals are processed as motor excitation to the Mach
R feel motors.

R Both Mach feel channels are normally engaged but only
R channel 1 provides the command output signal. The
R second channel is used for cross-channel comparison
R monitoring and its output is inhibited. However, if
R channel 1 is disengaged due to a failure or
R selectively, the channel 2 output is automatically
R enabled.

R (3) Mach Feel Command

R Each Mach feel channel in the trim augmentation
R computer receives a Mach number signal from the
R associated air data computer (ADC). The computer Mach
R feel channel operation is independent but similar to
R the Mach trim channel. The Mach number inputs used by
R the Mach trim channels are also routed to the Mach feel
R channels. The Mach number input signal is shaped and
R limited by the computer and then applied to the servo
R amplifier circuits to drive the Mach feel motors in the
R electrical trim and feel assembly. The output shaft of
R the Mach feel motor is coupled thorugh gears to the
R Mach feel spring mechanism. The mechanism changes the
R state of the feel spring proportional to Mach number.
R In addition to operating the Mach feel spring
R mechanism, the Mach feel motor drives a rate generator
R and a linear variable differential transformer (LVDT).
R The output signal of the rate generator is proportional
R to the speed of the Mach feel motor, and is fed back
R and summed into the Mach feel input circuit. This
R feedback signal provides damping of the system by
R reducing the effect of the feel command signal. This
R in turn dampens the action of the feel spring mechanism
R so that it does not overshoot the desired position.
R The LVDT generates a signal which indicates the amount
R of feel spring force that the Mach feel motor has



R Mach Feel System Equipment and Location
R Figure 4

EFFECTIVITY: ALL

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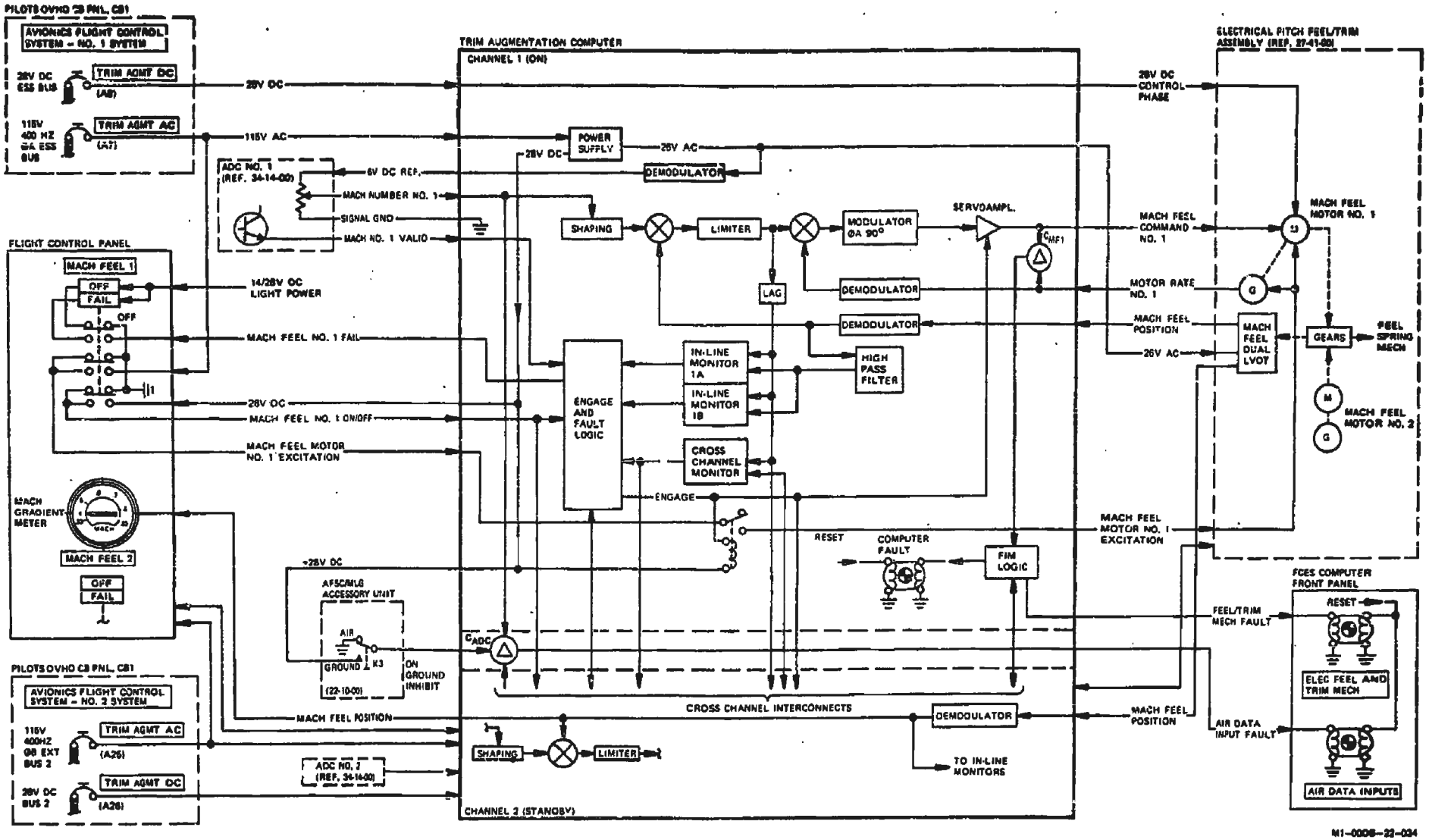

R Mach Feel System Functional Block Diagram
R Figure 5

EFFECTIVITY: ALL

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commanded. This LVDT signal is fed back and summed into the Mach feel signal input circuit. The purpose of this feedback signal is to assure that the system stops at the state of the feel spring commanded by the Mach feel signal input circuit. This feedback signal is also fed back through the trim augmentation computer to the Mach gradient meter on the Flight Control Panel.

(4) Mach Feel In-Line Monitor

R The channel engagement requires the presence of the Mach valid signal from the associated air data computer and channel-on signal from the flight control panel. Any invalid signal causes the computer to provide a fail logic signal to the associated MACH FEEL switchlight on the flight control panel; the FAIL message of the switchlight comes on.

An in-line monitor in each Mach feel channel continuously monitors the channel. If the monitor detects a failure, the related engage logic automatically inhibits the feel command output signal. At the same time, the logic circuit provides a fail logic signal to the associated MACH FEEL switchlight.

R (5) Mach Feel Cross-channel Monitor

A cross-channel monitor is also included in the computer to compare the Mach feel command signal inputs to the servo loop of both channels. The two signals must be compatible to within a preset threshold for both Mach feel channels to be operational. If the monitor detects a deviation above the preset threshold, the related logic circuit in both channels automatically inhibits the channels.

(6) Mach Feel Fault Isolation Monitor

A fault isolation monitor (FIM) is included in each channel of the trim augmentation computer for ground maintenance purposes. The FIM isolates a failure to a certain input, the computer, or the output of the speed-attitude correction system. A computer failure isolated by either FIM is indicated by the FIM annunciator on the computer front panel. In addition to computer failures, the FIMs isolate failures to the air data inputs or the electrical mechanisms. The monitoring FIM sends an annunciation logic signal (ground) to set the associated FIM annunciator on the FCES computer front panel. The annunciators on the FCES computer which apply to the speed-attitude

correction system are AIR DATA INPUTS and ELEC FEEL & TRIM MECH.

C. Trim Augmentation Computer

The Trim Augmentation Computer is located in the forward electronic service center, center rack (Ref. Fig. 4). Aircraft AC and DC power are fed to the computer, which processes this power to energize various components of the Mach Feel system such as computer power supplies, control circuits, motor circuits, monitor circuits, and fault logic circuits. The primary function of the computer Mach feel portion is to monitor the Mach number of the ADC and drive the Mach feel motors. In addition, the computer utilizes the monitor and fault logic circuits to compare the operation of the two ADC units and the two Mach feel channels. Should a failure occur, these circuits select the active channel, and indicate the failure on the FCES Computer, the Trim Augmentation Computer, and the Flight Control Panel. For a detailed description of the trim augmentation computer, see 22-18-00.

D. Flight Control Panel

The flight control panel is located on the pilots overhead control panel (Ref. Fig. 4). The flight control panel contains the MACH FEEL 1 and 2 switchlights, and MACH indicator to monitor and control the dual channel Mach feel control system. The switchlights have FAIL-OFF legends. If a channel fails the FAIL message comes on. When the switchlight is depressed, the FAIL message goes out and the OFF message comes on. The OFF message indicates that the channel has been disengaged. Detection of a Mach feel system channel failure is provided by the trim computer. The switchlights also provide selective engagement and disengagement of the Mach feel system channels during normal operation.

A Mach feel system position indicator (MACH) is used to monitor the automatic system operation. The indicator is calibrated to display the actual position of the system at all times as a function of Mach number. For a detailed description of the flight control panel, see 22-10-00.

E. Mach Feel Motor

The operation of the Mach feel motor, rate generator and LVDT is identical to the operation of the Mach trim motor described in Paragraph 2E.

F. Mach Feel System Interface

The Mach feel system interfaces with the following equipment:

34-14-00 Air Data Computer

22-10-00 AFCS/MLG Accessory Unit

27-41-00 Electrical Pitch Feel/Trim Assembly

22-17-00 FCES Computer

(1) Air Data Computer (ADC)

There are two air data computers located on the forward electronics service center rear rack, shelf 5, zone 113. Each ADC provides a valid signal and a signal proportional to the aircraft Mach number to the corresponding Mach feel system. The Mach number signal is derived from a potentiometer in the ADC which is excited by a reference signal from the trim augmentation computer. For a detailed description of the air data computer, see 34-14-00.

(2) AFCS/MLG Accessory Unit

The AFCS/MLG accessory unit is located in the forward electronics service center, center rack. The unit provides the trim augmentation computer a signal that indicates whether the aircraft is airborne or on the ground. The trim augmentation computer uses the signal to inhibit the AIR DATA INPUTS, fault FIM when the aircraft is on the ground. For a detailed description of the unit, see 22-10-00.

(3) Electrical Pitch Feel/Trim Assembly (Left)

The electrical pitch Feel/Trim assembly is located in the lower afterbody section, and, is mounted just inboard of the left stabilizer servo module. The assembly receives and processes Mach feel electrical signals as well as all electrical trim (pilots thumbwheels) autopilot trim, and Mach trim. For a detailed description of the assembly, see 27-41-00.

(4) FCES Computer

The FCES computer is located on the forward electronics service center, center rack. The FCES computer front panel provides FIM indications for ELEC FEEL & TRIM MECH, and for AIR DATA INPUTS. For a detailed description of the FCES Computer, see 22-17-00.

R # MACH TRIM AND FEEL SYSTEM - FAULT ISOLATION

R 1. General

R Reference data and fault isolation procedures for troubleshooting Mach Trim/Feel System faults are included in this section of the manual. A Mach Trim or Mach Feel malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use system oriented fault isolation (Ref. Paragraph 4B). Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

R Mach Trim/Feel fault isolation contains two levels of trouble shooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 4A) trouble shoots a Specific Mach trim or feel problem. System oriented fault isolation (Ref. Paragraph 4B) tests and trouble shoots the Mach trim and feel system.

R 2. Referenced Procedures

R	21-25-00	Electronic and Electrical Service Centers Exhaust System - Adjustment and Test
R	24-00-00	Electrical Power - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	34-14-00	ADC System - Maintenance Practices

R 3. Equipment and Materials

R Breakout Cable Assembly for Trim Augmentation Computer, G/ITEL No. 22-00-19 (See Figure 108, 22-12-37). (One Req.)

R 4. Fault Isolation Identification

R Table 101 is a list of the Mach Trim and Feel fault isolation
R diagrams and schematics. Figure 101 and 102 provide component
R location for the Mach Trim and Feel troubleshooting.

R Fault Isolation Diagrams and Schematics List
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Mach Trim/Feel Fault Matrix
104	Mach Trim Fault Isolation
105	Mach Feel Fault Isolation
SCHEM 1	Trim Augmentation Computer Power Distribution Schematic
SCHEM 2	Mach Trim Signal Flow Schematic
SCHEM 3	Mach Trim Logic Schematic
SCHEM 4	Mach Feel Signal Flow Schematic
SCHEM 5	Mach Feel Logic Schematic
SCHEM 6	Trim Augmentation Computer FIM Schematic

R A. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported
R malfunction which is a result of a single failure. Figure
R 103 identifies a fault within the MACH TRIM or MACH FEEL
R system by a specific fault number. It also identifies and
R locates the LRU's which can cause the problem. For faults
R not listed in Figure 103, perform System Oriented Fault
R Isolation in Paragraph 4B to isolate problem.

R Figures 104 and 105 provide diagnostic steps to further
R isolate the fault. The diagnostic steps are in a flow-chart
R form which contains complete fault isolation procedures for
R each fault. Action instructions are contained within the
R blocks of the flow chart while the monitored results of the
R actions outside the blocks. When using the flow charts, it
R is assumed that systems are in the normal operational mode,
R all relevant circuit breakers have been checked, and all

R applicable aircraft operational procedures have been
R accomplished.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ASSEMBLY – PITCH FEEL AND TRIM ELECTRICAL (LEFT)	1	AFTERBODY/317BB	27-41-16
COMPUTER – AIR DATA	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – TRIM AUGMENTATION	1	FESC, REAR RACK/112AB	22-18-01
MOTOR – MACH FEEL	2	AFTERBODY, ON PITCH TRIM AND FEEL ASSY/317BB	22-21-02
MOTOR – MACH TRIM	2	AFTERBODY, ON PITCH TRIM AND FEEL ASSY/317BB	22-21-01
PANEL – FCES CONTROL	1	FLT STA, PILOTS OVHD PNL	22-10-07
PANEL – FLIGHT CONTROL	1	FLT STA, PILOTS OVHD PNL	22-10-09

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R
R Component Location Index
Figure 101

EFFECTIVITY: ALL

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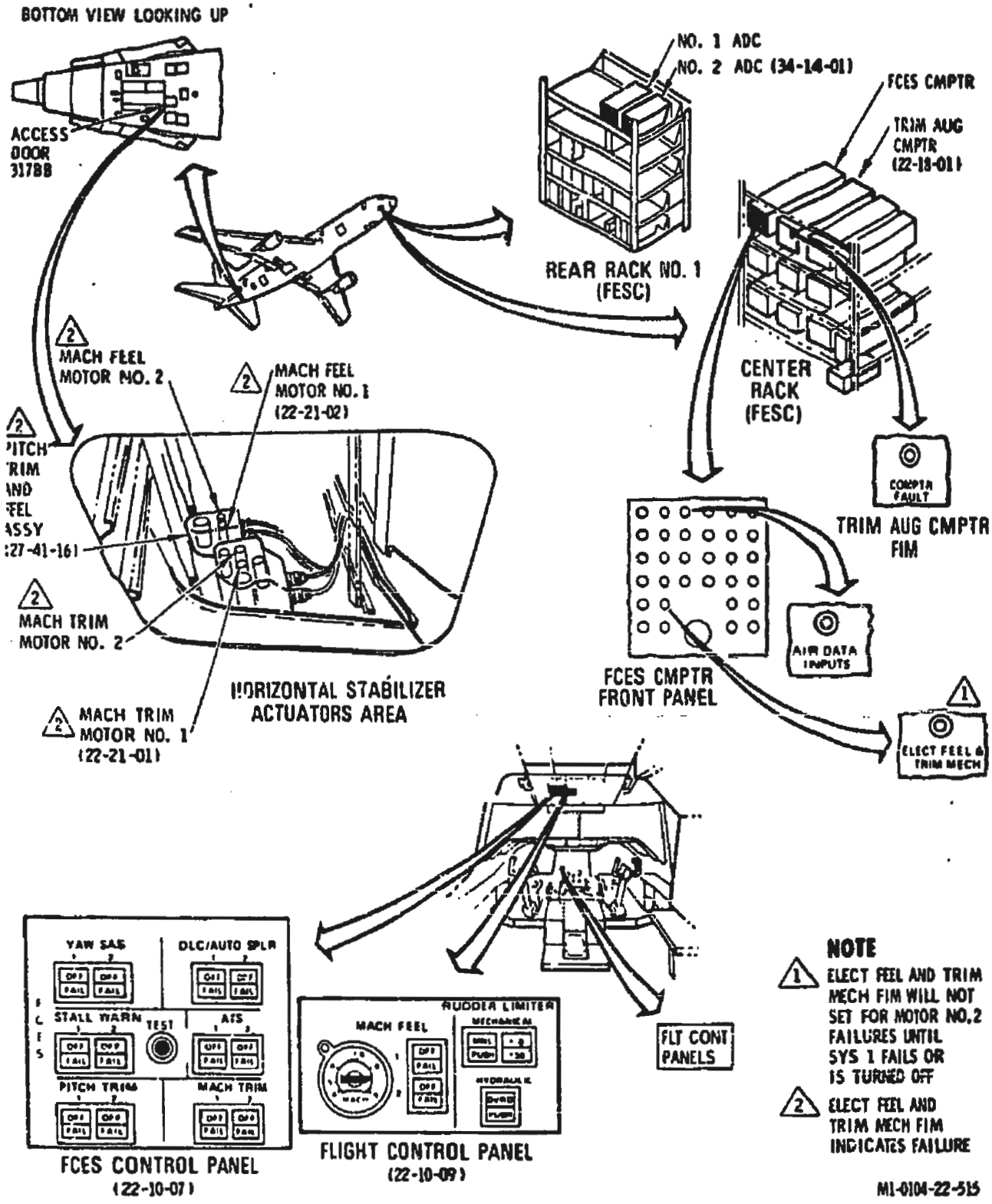
BOTTOM VIEW LOOKING UP
ACCESS DOOR 317BB
NO. 1 ADC
NO. 2 ADC (34-14-01)
FCES CMPTR
TRIM AUG CMPTR (22-18-01)
REAR RACK NO. 1 (FESC)
CENTER RACK (FESC)
2 MACH FEEL MOTOR NO. 2
2 MACH FEEL MOTOR NO. 1 (22-21-02)
2 PITCH TRIM AND FEEL ASSY (27-41-16)
2 MACH TRIM MOTOR NO. 2
2 MACH TRIM MOTOR NO. 1 (22-21-01)
HORIZONTAL STABILIZER ACTUATORS AREA
COMPTR FAULT
TRIM AUG CMPTR FIM
AIR DATA INPUTS
FCES CMPTR FRONT PANEL
1 ELECT FEEL & TRIM MECH
YAW SAS
DLC/AUTO SPLR
STALL WARN
TEST
AFS
PITCH TRIM
MACH TRIM
FCES CONTROL PANEL (22-10-07)
MACH FEEL
RUDDER LIMITER
FLIGHT CONTROL PANEL (22-10-09)
FLT CONT PANELS
NOTE
1 ELECT FEEL AND TRIM MECH FIM WILL NOT SET FOR MOTOR NO.2 FAILURES UNTIL SYS 1 FAILS OR IS TURNED OFF
2 ELECT FEEL AND TRIM MECH FIM INDICATES FAILURE
M1-0104-22-515

R
R

Component Locator Diagram
Figure 102

EFFECTIVITY: ALL

0018

FAULTS ← → FIM ← → NO FIM

No.	Problem	Troubleshooting Faulty LRU: Check FIM on LRU or on Front Panel of FCES Cmptr: TAC	ADC	MT MOT	MF MOT	PF & TA	Continuity Check or Replace: FCES CP	FLT CP	MF RIG
"MACH TRIM" FAULTS (Ref. Fig. 104)									
1	MACH TRIM 1 FAIL light on	X		1		X	X		
2	PITCH TRIM 1, MACH TRIM 1, MACH FEEL 1 FAIL lights on	X							
3	MACH TRIM 1, MACH FEEL 1 FAIL lights on	X	1						
3A	MACH TRIM 1, MACH FEEL 1, FAIL lights on MACH flag on Capt AS MACH ind		1						
4	MACH TRIM 2 FAIL light on (5)	X		2		X	X		
5	PITCH TRIM 2, MACH TRIM 2, MACH FEEL 2 FAIL lights on	X							
6	MACH TRIM 2, MACH FEEL 2 FAIL lights on	X	2						
6A	MACH TRIM 2, MACH FEEL 2 FAIL lights on MACH flag on F/O AS MACH ind		2						
7	Both MACH TRIM FAIL lights on	X		1 2		X			
8	Both MACH TRIM FAIL lights on. Either MACH TRIM 1 or 2 will operate with other Chan OFF	X	1 2						
9	Both MACH TRIM and both MACH FEEL FAIL lights on	X							
10	Both MACH TRIM and both MACH FEEL FAIL lights on. Either MACH TRIM FEEL 1 or 2 will operate with other Chan OFF	X	1 2						
"MACH FEEL" FAULTS (Ref. Fig 105)									
21	MACH FEEL 1 FAIL light on	X			1	X		X	
22	MACH FEEL 2 FAIL light on (5)	X			2	X		X	
22A	MACH FEEL 2 FAIL light on. Flt Cont Pnl MACH ind inoperative	X				X			
23	Both MACH FEEL FAIL lights on	X			1 2	X			X
23A	Both MACH FEEL FAIL lights on. Either MACH FEEL 1 or 2 will operate with other Chan OFF	X	1 2						
24	MACH ind (Flt Cont Pnl) inop	X						X	

Abbreviations		R and I Ref: Chap	Page
ADC	Air Data Computer	34 14 01	401
FCES CP	FCES Control Panel	22 10 07	401
FLT CP	Flight Control Panel	22 10 09	401
MF MOT	MACH FEEL MOTOR	22 21 02	401
MF RIG	MACH FEEL rigging (Table 102, Procedure 2)		
MT MOT	MACH TRIM Motor	22 21 01	401
PF & TA	Pitch Feel and Trim Assy	27 41 16	401
TAC	Trim Augmentation Computer	22-18-01	401
X	One LRU Common to Both Sys		
1/2	No 1 (2) LRU Assoc with Sys 1 (2) Problem		

HOW TO USE

1. Find flight squawk in FAULTS column.
2. Check FIM on LRU's listed in FIM column related to FAULTS. Black FIM - LRU good. White or Yellow FIM - Replace LRU
3. If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS
4. If problem persists: Refer to Fig. 104 or 105

(5) See Fig. 102 Note 1.

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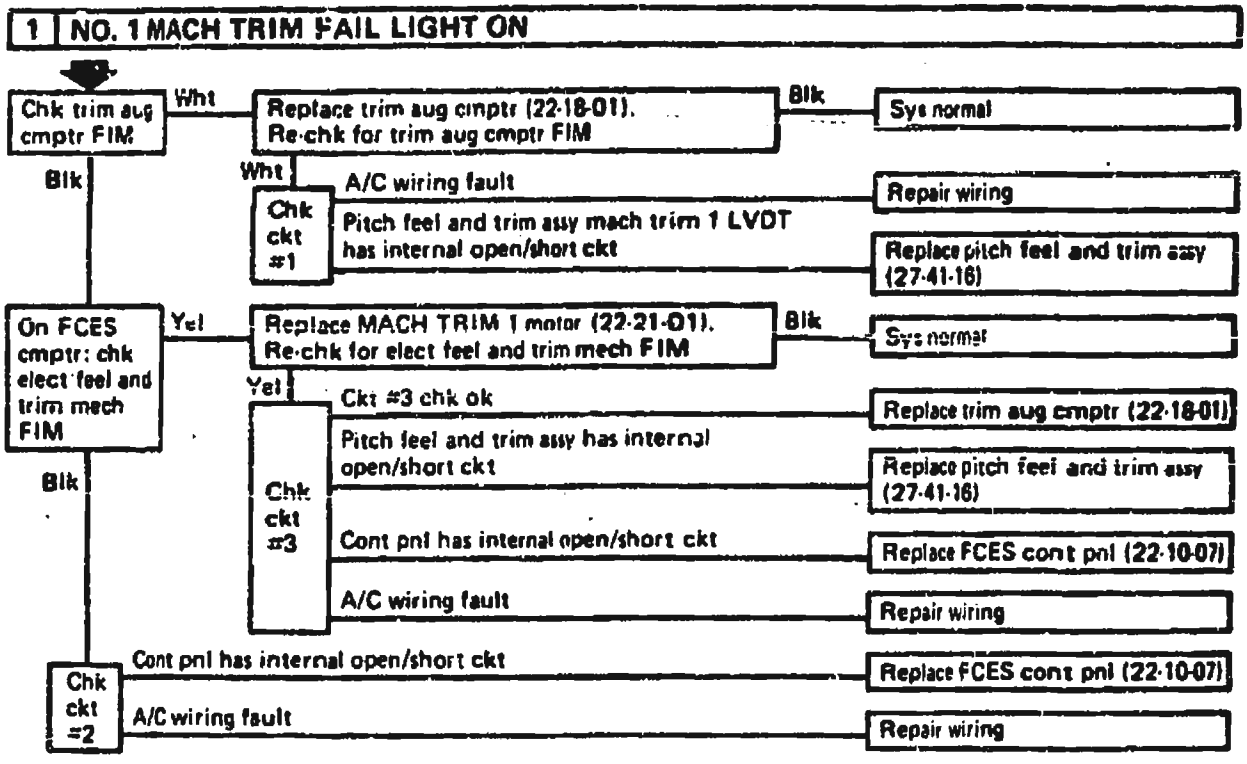
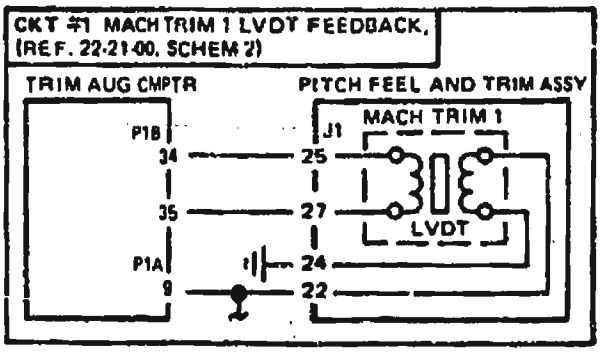
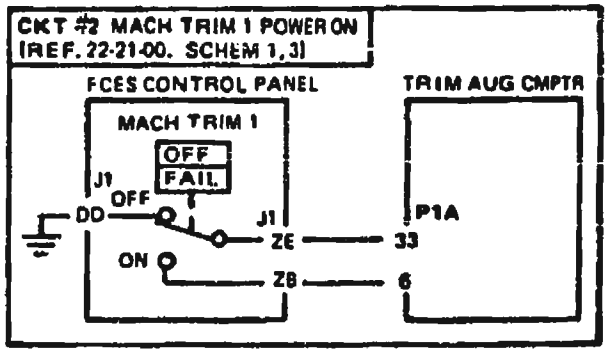
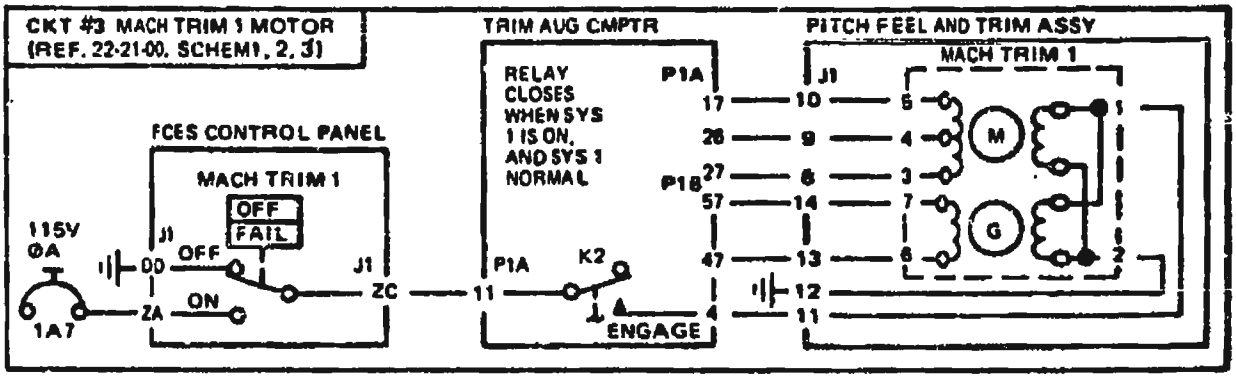
R R Mach Trim/Feel Fault Matrix
Figure 103


1 NO. 1 MACH TRIM FAIL LIGHT ON
Chk trim aug cmptr FIM
Wht
Replace trim aug cmptr (22-18-01). Re-chk for trim aug cmptr FIM
Blk
Sys normal
Blk
Wht
A/C wiring fault
Repair wiring
Chk ckt #1
Pitch feel and trim assy mach trim 1 LVDT has internal open/short ckt
Replace pitch feel and trim assy (27-41-16)
On FCES cmptr: chk elect feel and trim mech FIM
Yel
Replace MACH TRIM 1 motor (22-21-01). Re-chk for elect feel and trim mech FIM
Blk
Sys normal
Yel
Ckt #3 chk ok
Replace trim aug cmptr (22-18-01)
Chk ckt #3
Pitch feel and trim assy has internal open/short ckt
Replace pitch feel and trim assy (27-41-16)
Cont pnl has internal open/short ckt
Replace FCES cont pnl (22-10-07)
A/C wiring fault
Repair wiring
Blk
Chk ckt #2
Cont pnl has internal open/short ckt
Replace FCES cont pnl (22-10-07)
A/C wiring fault
Repair wiring







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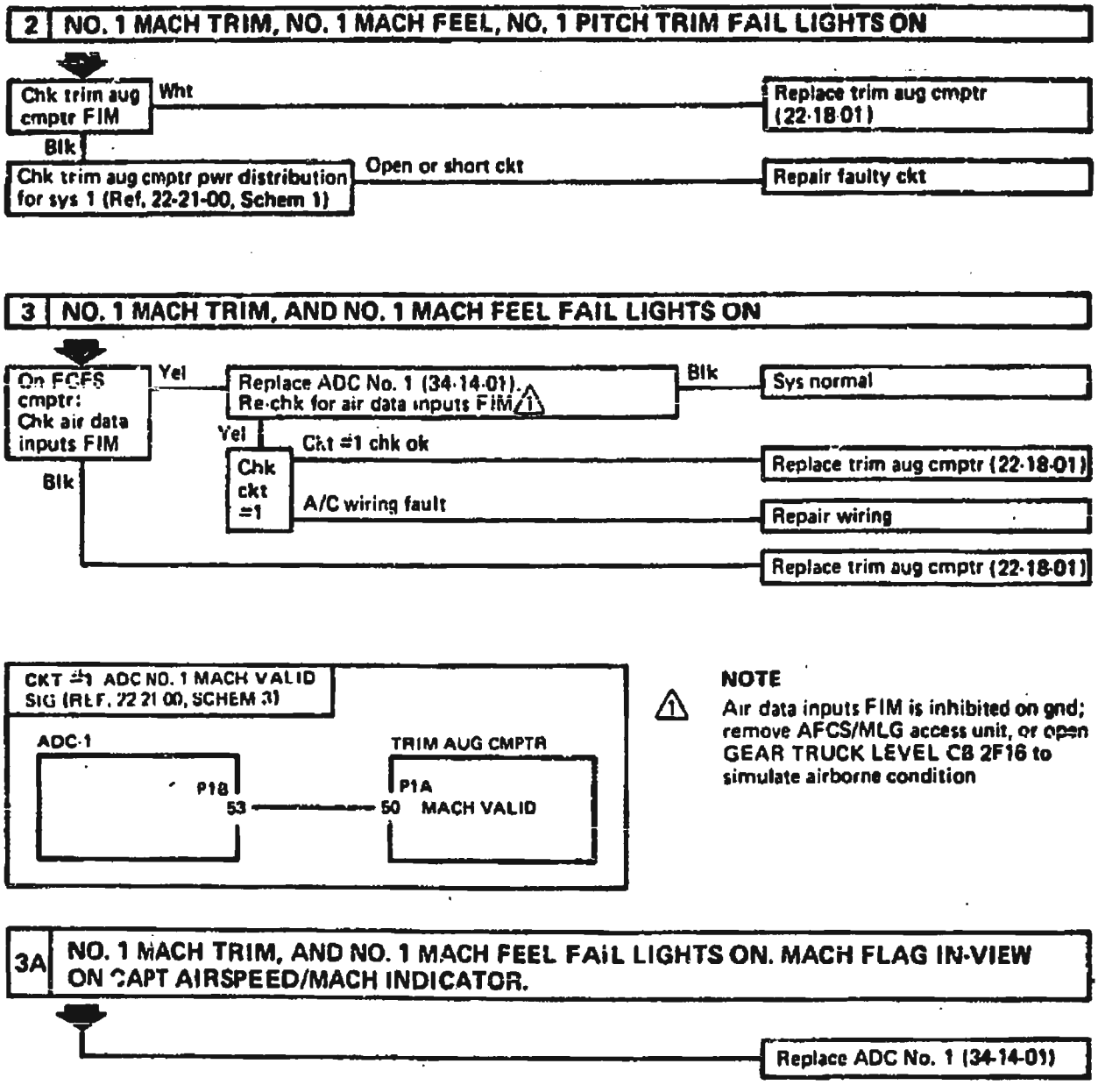
R Mach Trim Fault Isolation
R Figure 104 (Sheet 1)

EFFECTIVITY: ALL

001B


2 NO. 1 MACH TRIM, NO. 1 MACH FEEL, NO. 1 PITCH TRIM FAIL LIGHTS ON
Chk trim aug cmptr FIM
Wht
Replace trim aug cmptr (22-18-01)
Blk
Chk trim aug cmptr pwr distribution for sys 1 (Ref. 22-21-00, Schem 1)
Open or short ckt
Repair faulty ckt
3 NO. 1 MACH TRIM, AND NO. 1 MACH FEEL FAIL LIGHTS ON
On FCFS cmptr: Chk air data inputs FIM
Yel
Replace ADC No. 1 (34-14-01). Re-chk for air data inputs FIM
1
Blk
Sys normal
Yel
Chk ckt =1
Ckt =1 chk ok
Replace trim aug cmptr (22-18-01)
A/C wiring fault
Repair wiring
Blk
Replace trim aug cmptr (22-18-01)

1 **NOTE**

Air data inputs FIM is inhibited on gnd; remove AFCS/MLG access unit, or open GEAR TRUCK LEVEL CB 2F16 to simulate airborne condition

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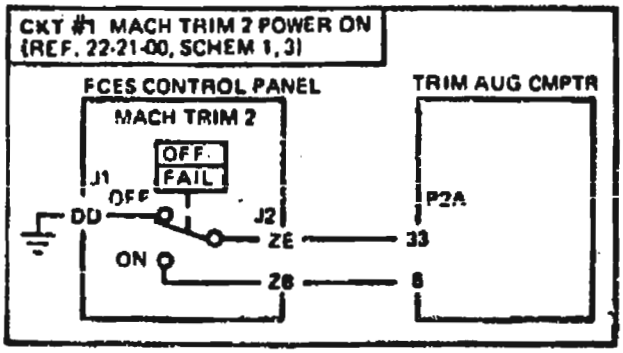
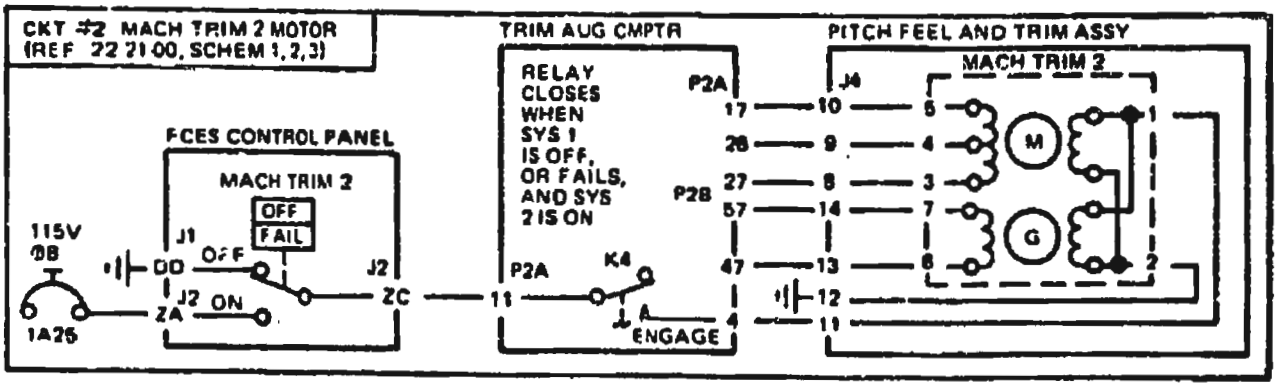
R
R

Mach Trim Fault Isolation
Figure 104 (Sheet 2)

4 NO. 2 MACH TRIM FAIL LIGHT ON

- Chk trim aug cmptr FIM
  - Wht → Replace trim aug cmptr (22-18-01)
  - Blk → Was sys 1 OFF or FAIL?
    - No → Chk ckt #1
    - Yes → On FCES cmptr: chk elect feel and trim mech FIM
      - Yel → Replace mach trim 2 motor (22-21-01). Re-chk for elect feel and trim mech FIM
        - Blk → Sys normal
        - Yel → Chk ckt #2
          - Ckt #2 chk OK → Replace trim aug cmptr (22-18-01)
          - Pitch feel and trim assy has internal open/short ckt → Replace pitch feel and trim assy (27-41-16)
          - Cont pnl has internal open/short ckt → Replace FCES cont pnl (22-10-07)
          - A/C wiring fault → Repair wiring
      - Blk → Chk ckt #1
        - Cont pnl has internal open/short ckt → Replace FCES cont pnl (22-10-07)
        - A/C wiring fault → Repair wiring





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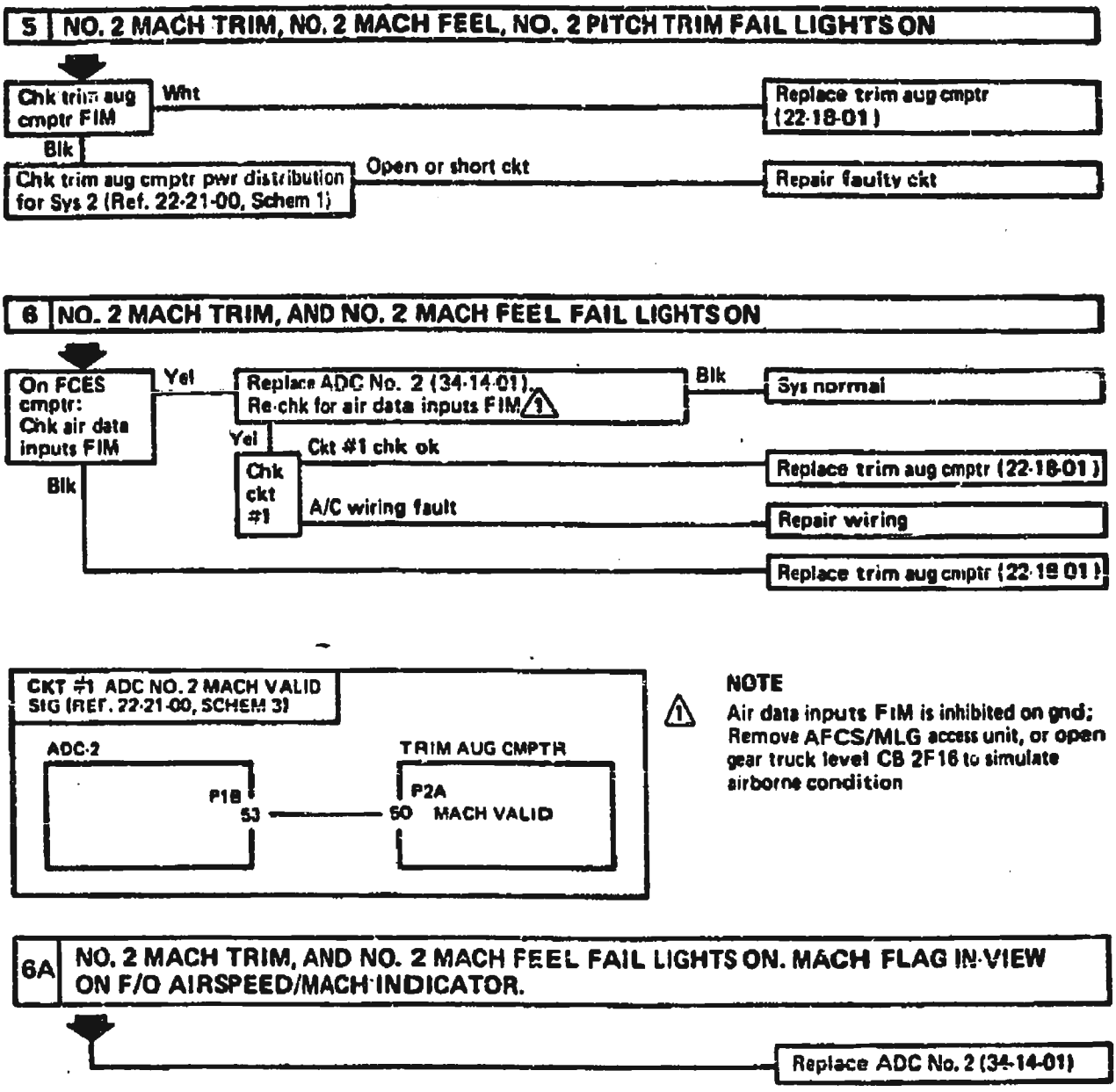
R Mach Trim Fault Isolation
R Figure 104 (Sheet 3)

EFFECTIVITY: ALL


5 NO. 2 MACH TRIM, NO. 2 MACH FEEL, NO. 2 PITCH TRIM FAIL LIGHTS ON
Chk trim aug cmptr FIM
Wht
Replace trim aug cmptr (22-18-01)
Blk
Chk trim aug cmptr pwr distribution for Sys 2 (Ref. 22-21-00, Schem 1)
Open or short ckt
Repair faulty ckt
6 NO. 2 MACH TRIM, AND NO. 2 MACH FEEL FAIL LIGHTS ON
On FCES cmptr: Chk air data inputs FIM
Yel
Replace ADC No. 2 (34-14-01). Re-chk for air data inputs FIM 1
Blk
Sys normal
Yel
Chk ckt #1
Ckt #1 chk ok
Replace trim aug cmptr (22-18-01)
A/C wiring fault
Repair wiring
Blk
Replace trim aug cmptr (22-18-01)
CKT #1 ADC NO. 2 MACH VALID SIG (REF. 22-21-00, SCHEM 3)
ADC-2
P1B
53
TRIM AUG CMPTR
P2A
50 MACH VALID
1
NOTE
Air data inputs FIM is inhibited on gnd; Remove AFCS/MLG access unit, or open gear truck level CB 2F16 to simulate airborne condition
6A NO. 2 MACH TRIM, AND NO. 2 MACH FEEL FAIL LIGHTS ON. MACH FLAG IN VIEW ON F/O AIRSPEED/MACH INDICATOR.
Replace ADC No. 2 (34-14-01)

M1-0102-22-570

R
R

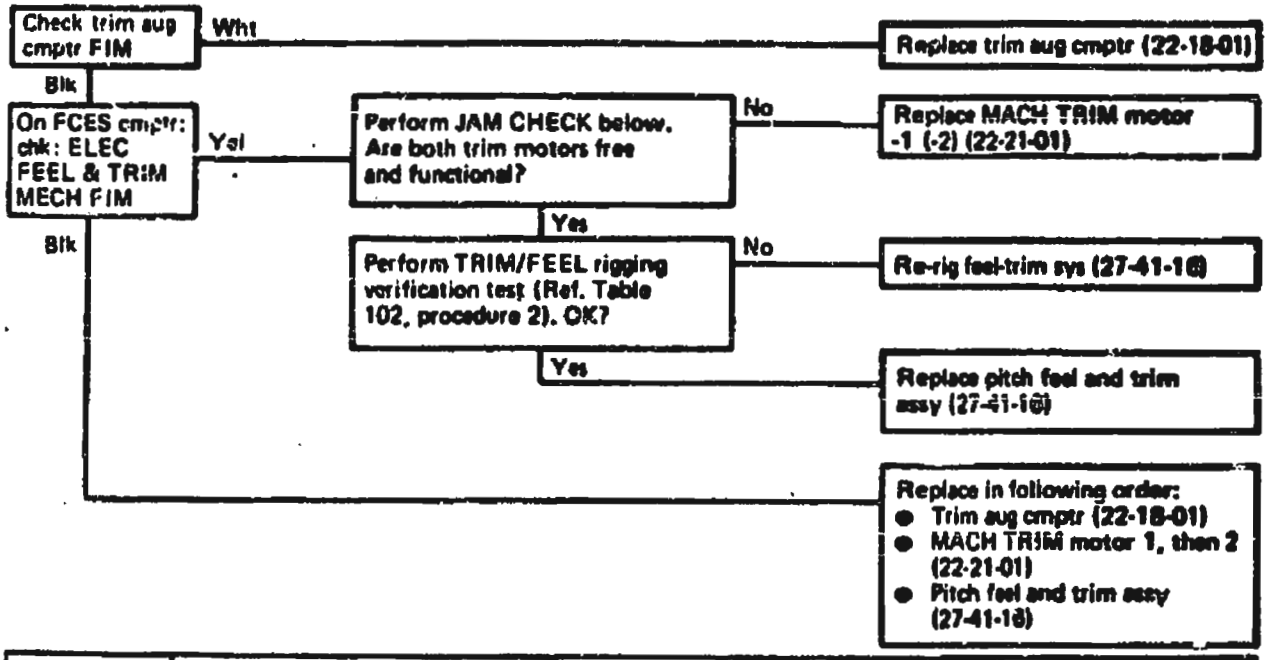
Mach Trim Fault Isolation
Figure 104 (Sheet 4)

EFFECTIVITY: ALL

001B

7 BOTH MACH TRIM FAIL LIGHTS ON

NOTE: When both MACH TRIM lights FAIL, Mach trim motors are prime suspect. The most common problem is motor binding which causes a bind in the gear train failing both systems.


Check trim aug cmptr FIM
Wht
Replace trim aug cmptr (22-18-01)
Blk
On FCES cmptr: chk: ELEC FEEL & TRIM MECH FIM
Yel
Perform JAM CHECK below. Are both trim motors free and functional?
No
Replace MACH TRIM motor -1 (-2) (22-21-01)
Yes
Blk
Perform TRIM/FEEL rigging verification test (Ref. Table 102, procedure 2). OK?
No
Re-rig feel-trim sys (27-41-16)
Yes
Replace pitch feel and trim assy (27-41-16)
Replace in following order:
• Trim aug cmptr (22-18-01)
• MACH TRIM motor 1, then 2 (22-21-01)
• Pitch feel and trim assy (27-41-16)

JAM CHECK

a. Depress both MACH TRIM sw lts to OFF.
b. Open 1A7, 1A8, 1A25, and 1A26 CB.
c. Leave electrical receptacles connected, remove mach trim motors clear of mounting plate (Ref. 22-21-01).
d. Check motors for frozen shaft or rough bearing by rotating motor shafts by hand. If motor is faulty, don't go any further in check.
e. Close CB opened in Step b.
f. Depress RESET sw on FCES cmptr to reset FIM.
NOTE: Three men required for following check (1 in flt sta, 1 in FESC, and 1 in stab servo area).
g. On aircraft with two analog type ADC, on both ADC simultaneously press and hold SELF TEST sw until directed to release. When altitude is reached, and flags go out of view, continue test.
g. On aircraft with two digital type ADC, on both ADC press PUSH TO TEST sw for 1 sec and release. When both TEST IN PROGRESS lights begin to flash, simultaneously press both PUSH TO TEST sw for 1 sec and release. When Mach indicator reaches 0.86, press and hold both PUSH TO TEST sw until directed to release.
g. On aircraft with mixed analog and digital type ADC, connect air data tester to acft (Ref. 34-13-00, page 501) and set airspeed and altitude to obtain a Mach 0.86 indication.
h. Depress both MACH TRIM sw lts to on (dark).
RESULT:
(1) Mach trim motor No. 1 will run, stop, and FAIL light will come on.
(2) Mach trim motor No. 2 will run, stop, and FAIL light will come on.
(3) FIM will set on trim aug cmptr.
(4) There will be no ELECT FEEL & TRIM MECH FIM on FCES cmptr.
i. On aircraft with matched ADC, release TEST switches.
i. On aircraft with mixed ADC, set airspeed and altitude to zero and remove air data tester.
j. If motors fail to operate in step h or fault is detected in step d, replace faulty motor.
k. If step h operates normal, JAM is in pitch feel and trim assy.
l. If motors are OK, reinstall them (Ref. 22-21-01).

M1-0000-22-2752

R
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Mach Trim Fault Isolation
Figure 104 (Sheet 5)

EFFECTIVITY: ALL

001B

8 BOTH MACH TRIM FAIL LIGHTS ON. EITHER MACH TRIM 1 OR 2 WILL OPERATE WITH OTHER CHANNEL OFF.

- Chk trim aug cmptr FIM
  - Wht → Replace trim aug cmptr (22-18-01)
  - Blk → On FCES cmptr: chk air data inputs FIM
    - Yel → Replace air data cmptr -1 (-2) (34-14-01)
    - Blk → Replace trim aug cmptr (22-18-01). If problem persists, replace air data cmptr -1 (-2) (34-14-01)

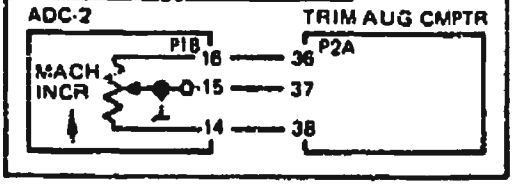
9 BOTH MACH FEEL AND BOTH MACH TRIM FAIL LIGHTS ARE ON.

- Replace trim aug cmptr (22-18-01)

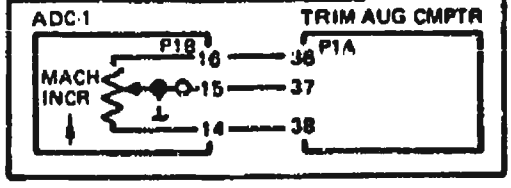
10 BOTH MACH FEEL AND BOTH MACH TRIM FAIL LIGHTS ARE ON. EITHER MACH TRIM/FEEL 1 OR 2 WILL OPERATE WITH OTHER CHANNEL OFF.

- On FCES cmptr: chk air data inputs FIM
  - Yel → Chk FIM on front of air data cmptr No. 1 and No. 2
    - Yel → Replace FIM indicated air data cmptr (34-14-01)
    - Blk → Chk ckt #1 and #2
      - A/C wiring fault → Repair wiring
      - Ckt #1 and #2 chk ok → Replace in following order:
        - Trim aug cmptr (22-18-01).
        - ADC-1 (34-14-01).
        - ADC-2 (34-14-01)
  - Blk → Replace trim aug cmptr (22-18-01)

CKT #1 ADC-2 MACH SIG FLOW (REF. 22-21-00, SCHEM 2)



CKT #2 ADC-1 MACH SIG FLOW (REF. 22-21-00, SCHEM 3)

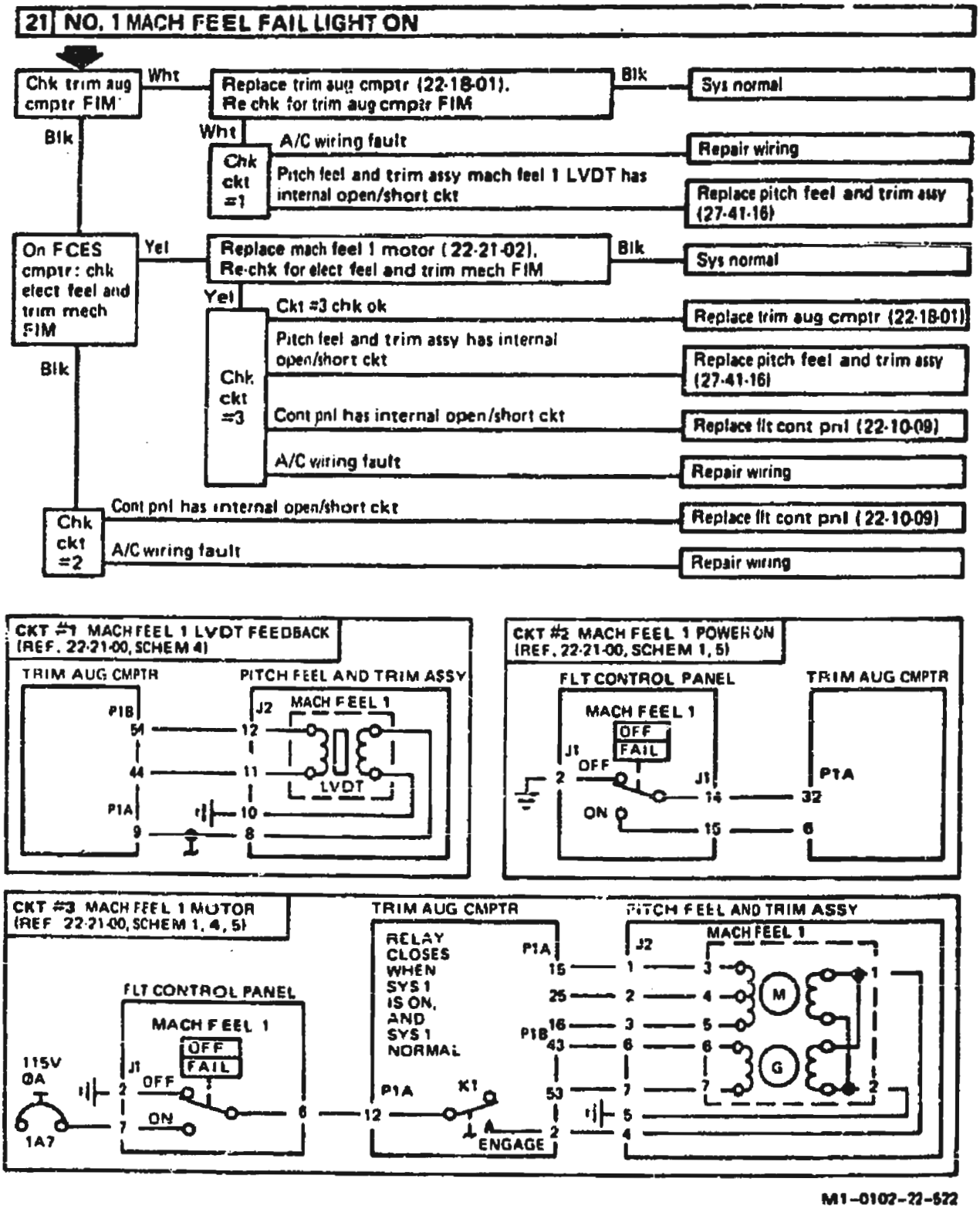


M1-0103-22-521

R Mach Trim Fault Isolation
R Figure 104 (Sheet 6)

EFFECTIVITY: ALL

001B


21 NO. 1 MACH FEEL FAIL LIGHT ON
Chk trim aug cmptr FIM
Wht
Replace trim aug cmptr (22-18-01). Re chk for trim aug cmptr FIM
Blk
Sys normal
Blk
Wht
Chk ckt =1
A/C wiring fault
Repair wiring
Pitch feel and trim assy mach feel 1 LVDT has internal open/short ckt
Replace pitch feel and trim assy (27-41-16)
On FCES cmptr: chk elect feel and trim mech FIM
Yel
Replace mach feel 1 motor (22-21-02). Re-chk for elect feel and trim mech FIM
Blk
Sys normal
Blk
Yel
Chk ckt =3
Ckt #3 chk ok
Replace trim aug cmptr (22-18-01)
Pitch feel and trim assy has internal open/short ckt
Replace pitch feel and trim assy (27-41-16)
Cont pnl has internal open/short ckt
Replace flt cont pnl (22-10-09)
A/C wiring fault
Repair wiring
Chk ckt =2
Cont pnl has internal open/short ckt
Replace flt cont pnl (22-10-09)
A/C wiring fault
Repair wiring
CKT #1 MACH FEEL 1 LVDT FEEDBACK (REF. 22-21-00, SCHEM 4)
TRIM AUG CMPTR
PITCH FEEL AND TRIM ASSY
MACH FEEL 1
LVDT
CKT #2 MACH FEEL 1 POWER ON (REF. 22-21-00, SCHEM 1, 5)
FLT CONTROL PANEL
TRIM AUG CMPTR
MACH FEEL 1
OFF
FAIL
ON
CKT #3 MACH FEEL 1 MOTOR (REF 22-21-00, SCHEM 1, 4, 5)
TRIM AUG CMPTR
PITCH FEEL AND TRIM ASSY
FLT CONTROL PANEL
MACH FEEL 1
RELAY CLOSES WHEN SYS 1 IS ON, AND SYS 1 NORMAL
115V
ENGAGE
M1-0102-22-522

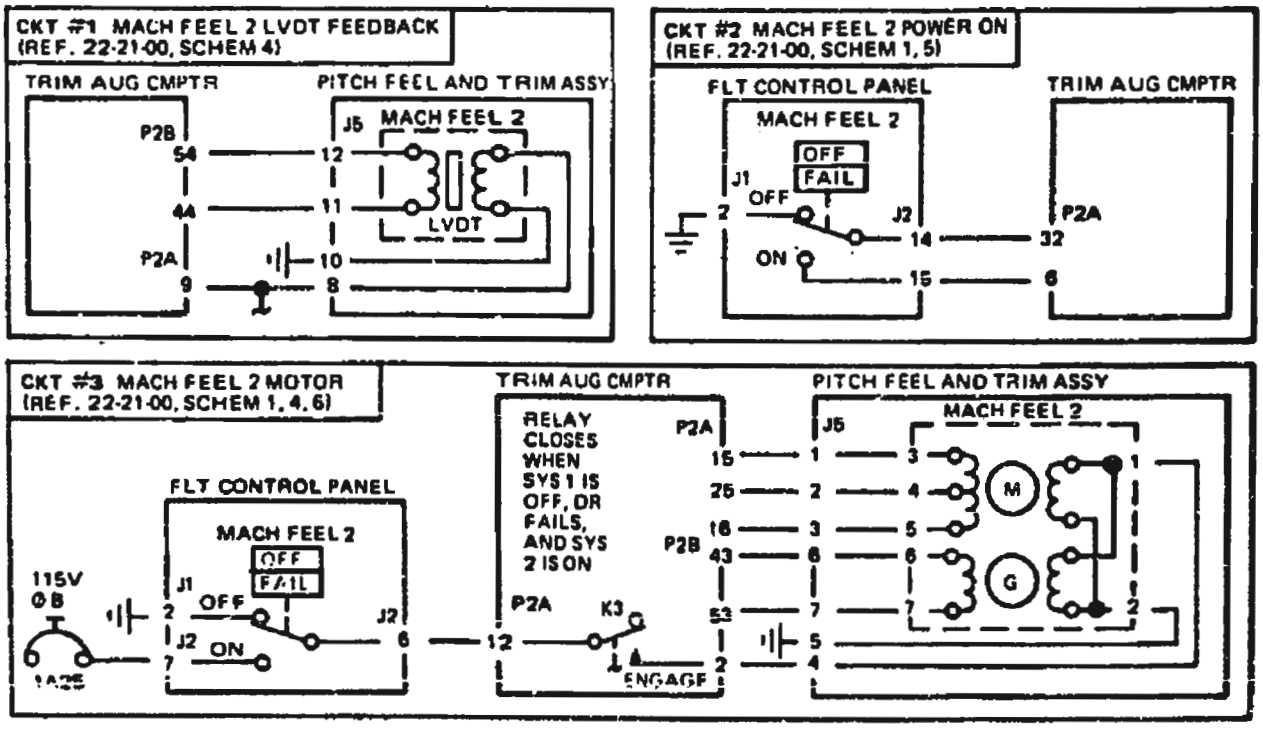
R Mach Feel Fault Isolation
R Figure 105 (Sheet 1)

EFFECTIVITY: ALL

001B

22 NO. 2 MACH FEEL FAIL LIGHT ON

- Chk trim aug cmptr FIM
  - Wht → Replace trim aug cmptr (22-18-01). Re chk for trim aug cmptr FIM
    - Blk → Sys normal
    - Wht → A/C wiring fault → Repair wiring
  - Blk → Chk ckt =1
    - Pitch feel and trim assy mach feel 2 LVDT has internal open/short ckt → Replace pitch feel and trim assy (27-41-16)
- On F CES cmptr: chk elect feel and trim mech FIM
  - Yel → Replace mach feel 2 motor (22-21-02) Re chk for elect feel and trim mech FIM
    - Blk → Sys normal
    - Yel → Chk ckt =3
      - Ckt #3 chk ok → Replace trim aug cmptr (22-18-01)
      - Pitch feel and trim assy has internal open/short ckt → Replace pitch feel and trim assy (27-41-16)
      - Cont pnl has internal open/short ckt → Replace flt cont pnl (22-10-09)
      - A/C wiring fault → Repair wiring
  - Blk → Chk ckt =2
    - Cont pnl has internal open/short ckt → Replace flt cont pnl (22-10-09)
    - A/C wiring fault → Repair wiring


CKT #1 MACH FEEL 2 LVDT FEEDBACK (REF. 22-21-00, SCHEM 4)
TRIM AUG CMPTR
PITCH FEEL AND TRIM ASSY
MACH FEEL 2
LVDT
CKT #2 MACH FEEL 2 POWER ON (REF. 22-21-00, SCHEM 1, 5)
FLT CONTROL PANEL
TRIM AUG CMPTR
MACH FEEL 2
OFF
FAIL
ON
CKT #3 MACH FEEL 2 MOTOR (REF. 22-21-00, SCHEM 1, 4, 6)
TRIM AUG CMPTR
PITCH FEEL AND TRIM ASSY
RELAY CLOSES WHEN SYS 1 IS OFF, OR FAILS, AND SYS 2 IS ON
FLT CONTROL PANEL
115V
ENGAGE

M1-0103-22-S23

R Mach Feel Fault Isolation
R Figure 105 (Sheet 2)

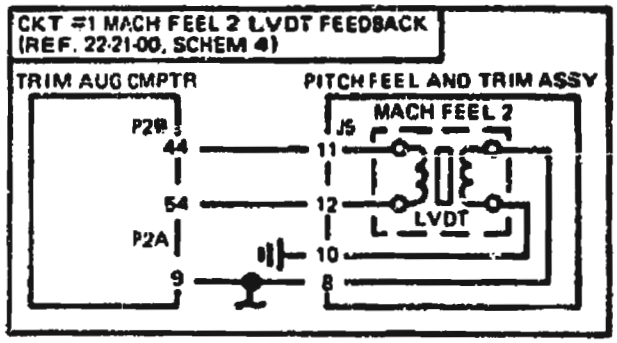
22A MACH FEEL 2 FAIL LIGHT ON, FLT CONT PNL MACH IND INOPERATIVE

Chk ckt =1

A/C wiring fault → Repair wiring

Pitch feel and trim assy mach trim 2 LVDT has internal open/short ckt → Replace pitch feel and trim assy (27-41-16)

This fault also causes trim aug cmptr FIM. If ckt =1 chk OK, then replace trim aug cmptr (22-18-01)

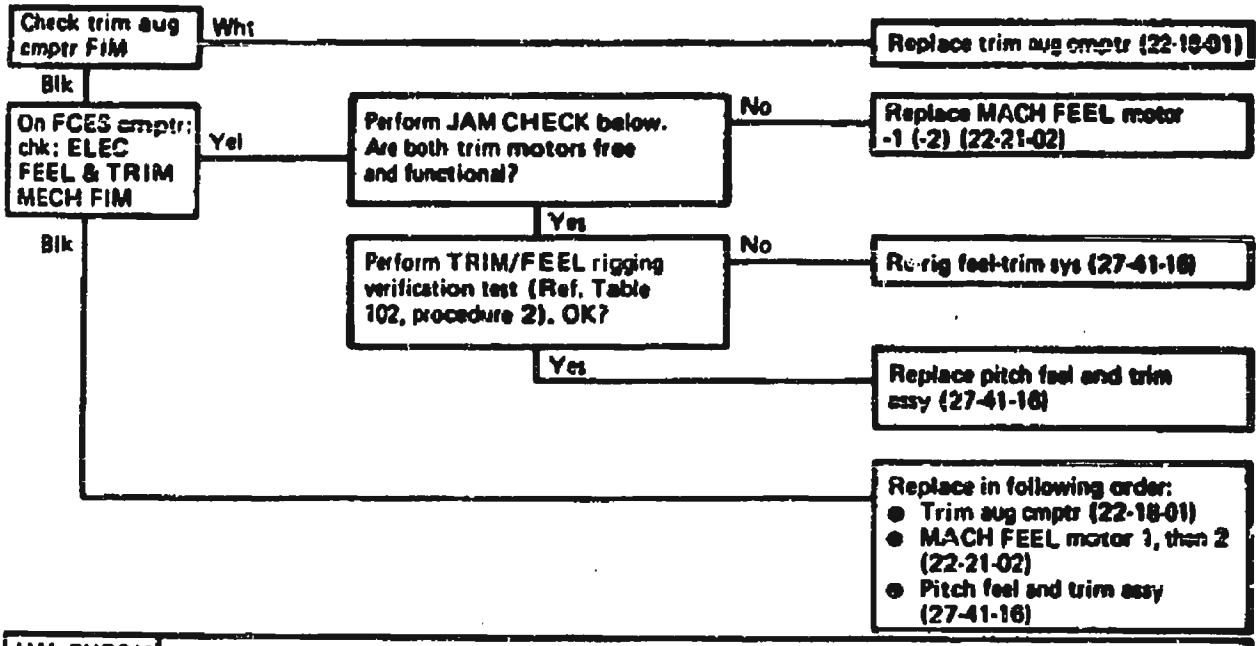


M1-0102-22-703

R R Mach Feel Fault Isolation
Figure 105 (Sheet 3)

23 BOTH MACH FEEL FAIL LIGHTS ON

NOTE: When both MACH FEEL lights FAIL, Mach feel motors are prime suspect. The most common problem is motor binding which causes a bind in the gear train failing both systems.


Check trim aug cmptr FIM
Wht
Replace trim aug cmptr (22-18-01)
Blk
On FCES cmptr: chk: ELEC FEEL & TRIM MECH FIM
Yel
Perform JAM CHECK below. Are both trim motors free and functional?
No
Replace MACH FEEL motor -1 (-2) (22-21-02)
Yes
Blk
Perform TRIM/FEEL rigging verification test (Ref. Table 102, procedure 2). OK?
No
Re-rig feel-trim sys (27-41-16)
Yes
Replace pitch feel and trim assy (27-41-16)
Replace in following order:
• Trim aug cmptr (22-18-01)
• MACH FEEL motor 1, then 2 (22-21-02)
• Pitch feel and trim assy (27-41-16)

JAM CHECK

a. Depress both MACH FEEL sw lts to OFF.
b. Open 1A7, 1A8, 1A25, and 1A26 CB.
c. Leave electrical receptacles connected, remove mach feel motors clear of mounting plate (Ref. 22-21-02).
d. Check motors for frozen shaft or rough bearing by rotating motor shafts by hand. If motor is faulty, don't go any further in check.
e. Close CB opened in Step b.
f. Depress RESET sw on FCES cmptr to reset FIM.
NOTE: Three men required for following check (1 in flt sta, 1 in FESC, and 1 in stub servo area).
g. On aircraft with two analog type ADC, on both ADC simultaneously press and hold SELF TEST sw until directed to release. When altitude is reached, and flags go out of view, continue test.
g. On aircraft with two digital type ADC, on both ADC press PUSH TO TEST sw for 1 sec and release. When both TEST IN PROGRESS lights begin to flash, simultaneously press both PUSH TO TEST sw for 1 sec and release. When Mach indicator reaches 0.86, press and hold both PUSH TO TEST sw until directed to release.
g. On aircraft with mixed analog and digital type ADC, connect air data tester to acft (Ref. 34-13-00 page 501) and set airspeed and altitude to obtain a Mach 0.86 indication.
h. Depress both MACH FEEL sw lts to on (dark).
RESULT
(1) Mach feel motor No. 1 will run, stop, and FAIL light will come on.
(2) Mach feel motor No. 2 will run, stop, and FAIL light will come on.
(3) FIM will set on trim aug cmptr.
(4) There will be no ELECT FEEL & TRIM MECH FIM on FCES cmptr.
i. On aircraft with matched ADC, release TEST switches.
i. On aircraft with mixed ADC, set airspeed and altitude to zero and remove air data tester.
j. If motors fail to operate in step h or fault is detected in step d, replace faulty motor.
k. If step h operates normal, JAM is in pitch feel and trim assy.
l. If motors are OK, reinstall them (Ref. 22-21-02).

M1-0000-22-2763

R Mach Feel Fault Isolation
R Figure 105 (Sheet 4)

23A BOTH MACH FEEL FAIL LIGHTS ON. EITHER MACH FEEL 1 OR 2 WILL OPERATE WITH OTHER CHANNEL OFF.

Chk trim aug cmptr FIM

Wht → Replace trim aug cmptr (22-18-01)

Blk

On FCES cmptr: Chk air data inputs FIM

Yel → Replace air data cmptr -1(-2) (34-14-01)

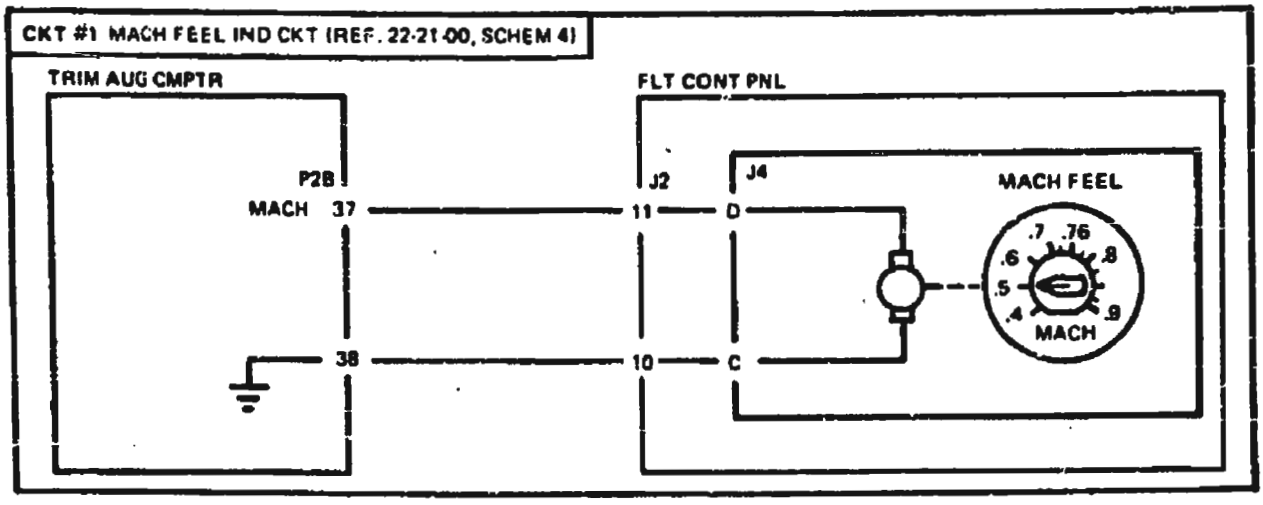
Blk → Replace trim aug cmptr (22-18-01) if problem persists, replace air data cmptr -1 (-2) (34-14-01)

24 MACH INDICATOR (FLT CONT PNL) INOPERATIVE

Does ind point "STRAIGHT UP"?

Yes → Replace flt cont pnl (22-10-09)

No → Replace trim aug cmptr (22-18-01). If problem persists, replace flt cont pnl (22-10-09) and chk Ckt #1



M1-0105-22-524

R R Mach Feel Fault Isolation
Figure 105 (Sheet 5)

EFFECTIVITY: ALL

001B

R B. System Oriented Fault Isolation

R Table 101 lists all Mach Trim/Feel system schematics. Table
R 102 contains the Mach Trim/Feel fault isolation procedure.
R See 22-18-00 for Pitch Trim System schematics and fault
R isolation.

R The System fault isolation procedure (Ref. Table 102)
R consists of a test procedure, normal observations, faults
R and corrective actions. The test procedure and normal
R observations are used to verify the operational status of
R the system. When a fault occurs during the test, perform
R corrective action adjacent to fault indication.

R If trouble shooting procedures as outlined in this section
R do not isolate the problem, consult the wiring diagram
R manual and use the signal intercept cables (G/ITEL No.
R 22-00-19) for further analysis and isolation of the problem.
R The signal intercept cable (T-Cable) permits monitoring of
R trim augmentation computer input/output functions with the
R systems fully operational.

Mach Trim/Feel Fault Isolation
Table 102

SET UP	ACTION	CHECK
1.	Turn on electrical power (Ref. 24-00-00).	
2.	.....	Avionics cooling is on. (Ref. 21-25-00).
3.	.....	On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed: TRIM AGMT AC (A7) (A25) TRIM AGMT DC (A8) (A26)
		On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed: PFCS ADS/PH (G8) FLT CONT ALT ALERT (G9)
	WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM: LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED. TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT. THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.	
4.	Turn on hydraulic systems A, B, C and D (Ref. 29-11-00).	

R Mach Trim/Feel Fault Isolation
R Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
A. MACH TRIM/FEEL SYSTEM TURN on.		
1. Check FIM on trim aug and FCES computers.	Trim aug computer FIM: • Black FCES computer FIM: • ELEC FEEL & TRIM MECH black. • AIR DATA INPUTS black.	Test OK.
	Trim aug computer FIM white.	Bad trim aug computer. Reset FIM, and confirm fault by continuing procedure.
	ELEC FEEL & TRIM MECH FIM yellow.	Bad electrical pitch feel trim assembly. Reset FIM, and confirm fault by continuing procedure.
	AIR DATA INPUTS yellow.	Bad ADC No. 1 or No. 2. Perform ADC SELF TEST and replace bad unit. If fault is not detected by SELF TEST, confirm fault by continuing procedure.
NOTE: AIR DATA INPUTS FIM is inhibited on ground. The AFCS/MLG accessory unit may be removed to simulate an airborne condition after resetting FIM to ensure proper corrective action.		
2. FCES panel. • Depress MACH TRIM 1 and 2 to on.	MACH TRIM lights dark.	Test OK.
• Depress MACH TRIM 2 to OFF.	Then MACH TRIM 2 OFF.	

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	MACH TRIM 1 legend FAIL.	MACH trim was shut off at high MACH. • Walk MACH FEEL ind on flight control pnl down to minimum MACH indication by depressing MACH FEEL 1 and MACH TRIM 1 to OFF when they FAIL, and then back on.
R R R R	Trim aug computer FIM white. On FCES computer, ELEC FEEL & TRIM MECH FIM yellow.	• Replace trim aug computer. • Check rigging (Step B). • Replace Mach feel schedule motor. • Replace electronic pitch feel trim assembly.
3. Flight control panel. • Depress MACH FEEL 1 and 2 to on.	MACH FEEL lights dark.	Test OK.
• Depress MACH FEEL 2 to OFF.	Then MACH FEEL 2 OFF.	

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	MACH FEEL 1 legend FAIL.	MACH TRIM was shut off at high MACH. • Walk MACH FEEL ind down to minimum MACH indication by depressing MACH FEEL 1 and MACH TRIM 1 to OFF when they FAIL, and then back on. Trim aug computer FIM white. • Replace trim aug computer. On FCES computer, ELEC FEEL & TRIM MECH FIM yellow. • Check rigging (Step B). • Replace electronic pitch feel trim assembly.

Mach Trim/Feel Fault Isolation
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
B. MACH TRIM/FEEL RIGGING VERIFICATION TEST.		
NOTE: The MACH TRIM/FEEL RIGGING VERIFICATION TEST, should be conducted in its entirety, if possible, prior to proceeding with corrective action.		
1. Check Capt and F/O AIRSPEED/MACH indicators.	Approx. 0.19 MACH.	No test
2. Depress MACH FEEL 1 to OFF.	MACH FEEL 1 OFF.	No test
3. Manually (by hand) turn Mach Feel Sync Shaft (Ref. Fig. 106) to LOW MACH STOP, and record number of turns required.	Between 3/4 and 1-1/2 turns	Test OK.
	Turns more or less than above tolerance.	Re-rig Mach feel system (Ref. 27-41-16).
4. Set manual trim wheel to 5.5 deg and mark wheel with tape.	Manual trim wheel approx. 5.5 deg.	No test.
5. Depress MACH FEEL 1 to on.	MACH FEEL 1 lights dark.	No test.
R NOTE: For aircraft with an analog Air Data Computer R installed in position 1, use the following Steps 6 thru 9.		

R Mach Trim/Feel Fault Isolation (Cont)
R Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
6. FESC ADC No. 1. • Depress SELF TEST and hold until directed to release in Step 9.	AIRSPEED/MACH ind • MACH flag in view for approx 1-1/2 min, then out of view. • 0.9 MACH. • 246 knots. ALTIMETER • 45,000 ft. Fit control panel. • Mach ind starts moving up scale and stops. • MACH FEEL 1 FAIL. FCES panel. • MACH TRIM 1 FAIL. Manual pitch trim wheel. • Starts to rotate towards nose-up and stops.	Test OK.
	AIRSPEED/MACH ind or ALTIMETER indications incorrect.	Replace indicator or ADC No. 1.
7. When AIRSPEED/MACH and ALTIMETER ind in Step 6 are reached: • Walk MACH FEEL ind up to 0.9 MACH by depressing MACH FEEL 1 and MACH TRIM 1 to OFF, when they FAIL, and then back on.	Continue walking until: • MACH FEEL 1 and MACH TRIM 1 do not FAIL. • Manual trim wheel stops moving. • MACH FEEL ind stops at approx. 0.9 MACH. Trim aug computer FIM white.	No test.
8. Depress MACH TRIM 1 and MACH FEEL 1 to OFF.		No test.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R R R R R R R	9. Release ADC SELF TEST sw.	AIRSPEED/MACH ind • Goes to ind prior to Step 6. ALTIMETER • Goes to ind prior to Step 6.	No test.
R R	NOTE: For aircraft with a digital Air Data Computer installed in position 1, use the following Steps 6 thru 9		
	6. FESC DADC No. 1. • Depress PUSH TO TEST for 1 second and release.	• All air data system No. 1 instruments Fail flags come into view. • MACH TRIM 1 FAIL light comes on • MACH FEEL 1 FAIL light comes on.	Test OK.
		DADC fails self test.	Replace indicator or DADC No. 1.
	7. When TEST IN PROGRESS light on DADC No. 1 starts to flash (approximately 10 seconds after start of self test in Step 6), depress PUSH TO TEST switch on DADC No. 1 for 1 second and release. • Reset MACH TRIM 1 and MACH FEEL 1 switchlights.	MACH FEEL MACH Ind. slowly moves up scale to maximum. • Manual Pitch Trim Wheel starts to rotate nose-up and stops. • Mach Feel Sync Shaft turns in high speed direction. • Capt AIRSPEED/MACH indicator increases to approximately 0.86 MACH.	No test.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
8. When Capt AIRSPEED/MACH indicator reaches (approximately 0.86 MACH) and stops, terminate DADC self test by depressing PUSH TO TEST for 1 second on DADC No. 1.	• Air data system No. 1 instrument Fail flags appear until system returns to ind prior to Step 6. • Capt AIRSPEED/MACH indicator returns to approximately 0.18 MACH. • MACH TRIM 1 FAIL light illuminates. • MACH FEEL 1 FAIL light illuminates.	No test.
9. Depress MACH FEEL 1 switch to OFF.	MACH FEEL MACH Ind. remains at maximum scale.	No test.
10. Flight control panel. • Record MACH ind	Approx. 0.9 MACH.	No test
11. Manual pitch trim wheel. • Record position	315 (±15) deg. from position marked in Step 4.	Test OK.
	Not 315 deg.	Re-rig Mach trim system (Ref. 27-41-16), or check for system friction (Ref. 27-41-16).
12. Manually (by hand) turn Mach Feel Sync Shaft (Ref. Fig. 106) to HIGH MACH STOP, and record number of turns required.	Between 3/4 and 1-1/2 turns.	Test OK.
	Turns more or less than above tolerance.	Re-rig Mach feel system (Ref. 27-41-16).

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
13. Walk MACH FEEL ind down to minimum MACH indication by depressing MACH FEEL 1 and MACH TRIM 1 to OFF when they FAIL, and then back on.	Continue walking until: • MACH FEEL 1 and MACH TRIM 1 do not FAIL. • Manual trim wheel stops moving at position marked in Step 4. • MACH FEEL ind stops at minimum MACH indication. Trim aug computer FIM white.	No test.
14. Depress MACH FEEL 1 and MACH TRIM 1 to OFF.		No test.
15. Depress MACH FEEL 2 and MACH TRIM 2 to on.		No test.
16. Depress MACH FEEL 2 to OFF.		No test.
17. Manually (by hand) turn Mach Feel Sync Shaft (Ref. Fig. 106) to LOW MACH STOP, and record number of turns required.	Between 3/4 and 1-1/2 turns.	Test OK.
	Turns more or less than above tolerance.	Re-rig Mach feel system (Ref. 27-41-16).
18. Verify position of manual trim wheel at 5.5 deg, and mark wheel with tape.	Manual trim wheel approx. 5.5 deg.	

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
19. Depress MACH FEEL 2 to on.	MACH FEEL 2 lights dark.	No test.
R NOTE: For aircraft with an analog Air Data Computer R installed in position 2, use the following Steps 20 thru 23.		
20. FESC ADC No. 2 • Depress SELF TEST and hold until directed to release in Step 23.	AIRSPEED/MACH ind • MACH flag in view for approx. 1-1/2 min, then out of view. • 0.9 MACH. • 246 knots. ALTIMETER • 45,000 ft. Flt control panel. • Mach ind starts moving up scale and stops. • MACH FEEL 2 FAIL. FCES panel. • MACH TRIM 2 FAIL. Manual pitch trim wheel. • Starts to rotate towards nose-up and stops.	Test OK.
	AIRSPEED/MACH ind or ALTIMETER indications incorrect.	Replace indicator or ADC No. 2.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
21. When AIRSPEED/MACH and ALTIMETER ind in Step 20 are reached: • Walk MACH FEEL ind up to 0.9 MACH by depressing MACH FEEL 2 and MACH TRIM 2 to OFF, when they FAIL, and then back on.	Continue walking until: • MACH FEEL 2 and MACH TRIM 2 do not FAIL. • Manual trim wheel stops moving. • MACH FEEL ind stops at approx. 0.9 MACH. Trim aug computer FIM white.	No test.
22. Depress MACH TRIM 2 and MACH FEEL 2 to OFF.		No test.
23. Release ADC SELF TEST sw.	AIRSPEED/MACH ind • Goes to ind prior to Step 20. ALTIMETER • Goes to ind prior to Step 20.	No test.
R NOTE: For aircraft with a digital Air Data Computer installed in position 2, use the following Steps 20 thru 23		
R 20. FESC DADC No. 2 • Depress PUSH TO TEST for 1 second and release.	• All air data system No. 2 instruments fail flags come into view. • MACH TRIM 2 FAIL light comes on • MACH FEEL 2 FAIL light comes on.	Test OK.
R	DADC fails self test.	Replace indicator or DADC No. 2.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
21. When TEST IN PROGRESS light on DADC No. 2 starts to flash (approximately 10 seconds after start of self test in Step 20), depress PUSH TO TEST switch on DADC No. 2 for 1 second and release. • Reset MACH TRIM 2 and MACH FEEL 2 switchlights.	MACH FEEL MACH ind slowly moves up scale up to maximum. • Manual Pitch Trim Wheel starts to rotate nose-up and stops. • Mach Feel Sync Shaft turns in high speed direction. • F/O AIRSPEED/MACH indicator increases to approximately 0.86 MACH.	
22. When F/O AIRSPEED/MACH indicator reaches maximum (approximately 0.86 MACH) and stops, terminate DADC self test by depressing PUSH TO TEST for 1 second on DADC No. 2.	• Air data system No. 2 instrument Fail flags appear until system returns to ind prior to Step 20. • F/O AIRSPEED/MACH indicator returns to approximately 0.18 MACH. • MACH FEEL 2 and MACH TRIM 2 FAIL lights illuminate.	No test.
23. Depress MACH FEEL 2 switch to OFF.	MACH FEEL MACH Ind remains at maximum scale.	No test.
24. Flight control panel • Record MACH ind	Approx. 0.9 MACH.	No test.
25. Manual pitch trim wheel • Record position.	Approx. 315 (±15) deg from position marked in Step 18.	Test OK.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Not 315 deg.	Re-rig Mach trim system (Ref. 27-41-16).
26. Manually (by hand) turn Mach Feel Sync Shaft (Ref. Fig. 106) to HIGH MACH STOP, and record number of turns required.	Between 3/4 and 1-1/2 turns.	Test OK.
	Turns more or less than above tolerance.	Re-rig Mach feel system (Ref. 27-41-16).
27. Walk MACH FEEL ind down to minimum MACH indication by depressing MACH FEEL 2 and MACH TRIM 2 to OFF when they FAIL, and then back on.	Continue walking until: • MACH FEEL 2 and MACH TRIM 2 do not FAIL. • Manual trim wheel stops moving at position marked in Step 18. • MACH FEEL ind stops at minimum MACH indication. Trim aug computer FIM white.	No test.
28. Trim aug computer • Reset FIM.		No test.

Mach Trim/Feel Fault Isolation
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	C. MACH TRIM SYSTEM TEST	
1. Depress MACH TRIM 2 and MACH FEEL 2 to OFF.		No test.
2. Verify that manual trim wheel is set to 5.5 deg.		No test.
R NOTE: For aircraft with an analog Air Data Computer R installed in position 1, use the following Steps 3 R thru 7.		
3. Connect air data tester to ADC No. 1 and No. 2. Establish an alt. of 30,000 ft. and a speed of 0.5 MACH.		No test.
4. Depress MACH TRIM 1 to on.		No test.
5. Mark manual trim wheel position with tape.		No test.
NOTE: Airspeed must be adjusted slowly. An excessive MACH rate of change will cause FAIL legends to come on.		
6. Using tester, increase speed to 0.95 MACH.	Manual trim wheel. • Rotates 315 deg. in NOSE-UP direction from position marked in Step 5.	Test OK.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	MACH TRIM 1 FAIL comes on, and MACH TRIM 1 system inoperative. Note MACH number.	Using tester, reduce speed to 0.5 MACH. Depress MACH TRIM 1 to OFF, then on. Using tester, increase speed to 0.95 MACH at a slower rate. • If FAIL consistent at or near same MACH number, ADC pot is noisy. Replace ADC No. 1.
	MACH TRIM 1 FAIL comes on, and MACH TRIM 1 system inoperative.	Check trim aug computer FIM, if white: • Replace trim aug computer. Check ELEC FEEL & TRIM MECH FIM on FCES computer, if yellow: • Replace Mach trim motor No. 1. • Replace electrical pitch trim feel assembly. • Check wiring between trim aug computer and electrical pitch trim feel assembly (Ref. WDM 22-18-09, 22-18-10).
	MACH TRIM 1 system inoperative without FAIL light.	Replace trim aug computer. Replace ADC No. 1. Check wiring between trim aug computer and ADC No. 1 (Ref. WDM 22-18-09, 22-18-10).
7. Using tester, decrease speed to 0.5 MACH.	Mach trim sync shaft (Ref. Fig. 106) returns to original position (Step 6).	No test.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R NOTE: For aircraft with a digital Air Data Computer installed in position 1, use the following Steps 3 thru 7.		
R 3. Depress MACH TRIM 1 to on.		No test.
R 4. Mark manual trim wheel position with tape.		No test.
R 5. FESC DADC No. 1. R • Depress PUSH TO TEST for 1 second and release.	• All air data system No. 1 instruments Fail flags come into view. • MACH TRIM 1 FAIL light comes on • MACH FEEL 1 FAIL light comes on.	Test OK.
R	DADC fails self test.	Replace indicator or DADC No. 1.
R 5A. When TEST IN PROGRESS light on DADC No. 1 starts to flash (approximately 10 seconds after start of self test in Step 5), depress PUSH TO TEST switch on DADC No. 1 for 1 second and release. R • Reset MACH TRIM 1 and MACH FEEL 1 switchlight.	MACH FEEL MACH Ind slowly moves up scale to max. • Manual Pitch Trim Wheel rotates 315 deg. in nose-up direction from position marked in Step 4. • Capt AIRSPEED/MACH indicator increases to approximately 0.86 MACH.	No test.

R Mach Trim/Feel Fault Isolation (Cont)
R Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
6. When Capt AIRSPEED/MACH indicator reaches maximum MACH. (approximately 0.86 MACH) and stops, terminate DADC self test by depressing PUSH TO TEST for 1 second on DADC No. 1.	• Air data system No. 1 instrument Fail flags appear until system returns to ind prior to Step 5. • Capt AIRSPEED/MACH indicator returns to approximately 0.18 MACH.	Test OK. • MACH TRIM 1 and MACH FEEL 1 FAIL lights come on.
7. Depress MACH FEEL 1 switch to OFF.	MACH FEEL MACH Ind remains at maximum scale.	No test.
	MACH TRIM 1 FAIL comes on during test and MACH TRIM 1 system inoperative. Note MACH number.	Walk MACH FEEL Ind down to minimum MACH indication by depressing MACH FEEL 1 and MACH TRIM 1 to OFF when they fail, then back on until they do not fail and indications return to same as prior to Step 5. Repeat test. • If FAIL consistent at or near same MACH number, ADC pot is noisy. Replace ADC No. 1.

R Mach Trim/Feel Fault Isolation (Cont)
R Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	MACH TRIM 1 FAIL comes on, and MACH TRIM 1 system inoperative.	Check trim aug computer FIM, if white; • Replace trim aug computer. Check ELEC FEEL & TRIM MECH FIM on FCES computer, if yellow: • Replace Mach trim motor No. 1. • Replace electrical pitch trim feel assembly. • Check wiring between trim aug computer and electrical pitch trim feel assembly (Ref. WDM 22-18-09, 22-18-10). •
	MACH TRIM 1 system inoperative without FAIL light.	Replace trim aug computer. Replace ADC No. 1. Check wiring between trim aug computer and ADC No. 1 (Ref. WDM 22-18-09, 22-18-10).
R 7A. Walk MACH FEEL ind down to minimum MACH indication by depressing MACH FEEL 1 and MACH TRIM 1 to OFF when they FAIL, and then back on.	Continue walking until • MACH FEEL 1 and MACH TRIM 1 do not fail. • Manual trim wheel stops moving at position marked in Step 4. • MACH FEEL ind stops at minimum MACH indication.	
8. Depress MACH TRIM 1 to OFF.		No test.
9. Depress MACH TRIM 2 to on.		No test.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
10. Mark manual trim wheel position with tape.		No test.
R NOTE: For aircraft with an analog Air Data Computer R installed in position 2 use the following Steps 11 R thru 13		
11. Using tester, increase speed to 0.95 MACH.	Manual trim wheel • Rotate 315 deg in NOSE-UP direction from position marked in Step 10.	Test OK.
	MACH TRIM 2 FAIL comes on, and Mach trim 2 system inoperative. Note Mach number.	Using tester, reduce speed to 0.5 MACH. Depress MACH TRIM 2 to OFF, then on. Using tester, increase speed to 0.95 at a slower rate. • If FAIL consistent at or near same MACH number, ADC pot noisy. Replace ADC No. 2.
	MACH TRIM 2 FAIL comes on, and Mach trim 2 system inoperative	Check trim aug computer FIM, if white: • Replace trim aug computer. Check ELEC FEEL & TRIM MECH FIM on FCES computer, if yellow: • Replace Mach trim motor No. 2. • Replace electrical pitch trim feel assembly. • Check wiring between trim aug computer and electrical pitch trim feel assembly (Ref. WDM 22-18-09, 22-18-10).

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Mach trim 2 system inoperative without FAIL light.	• Replace trim aug computer. • Replace ADC No. 2. • Check wiring between trim aug computer and ADC No. 2 (Ref. WDM 22-18-09, 22-18-10).
12. Using tester, decrease speed to 0.5 MACH.	Mach trim sync shaft (Ref. Fig. 106) returns to original position (Step 11).	No test.
13. Depress MACH TRIM 2 to OFF.		No test.
R NOTE: For aircraft with a digital Air Data Computer R installed in position 2, use the following Steps 11 R thru 15.		
R 11. FESC DADC No. 2 R • Depress PUSH TO TEST for 1 R second and release.	• All air data system No. 2 instruments Fail flags come into view. • MACH TRIM 2 FAIL light comes on • MACH FEEL 2 FAIL light comes on.	Test OK.
R	DADC fails self test.	Replace indicator or DADC No. 2.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
12. When TEST IN PROGRESS light on DADC No. 2 starts to flash (approximately 10 seconds after start of self test in Step 11), depress PUSH TO TEST switch on DADC No. 2 for 1 second and release. • Reset MACH TRIM 2 and MACH FEEL 2 switchlights.	MACH FEEL MACH Ind. slowly moves up scale to max. • Manual Pitch Trim Wheel rotates 315 degrees in nose-up direction from position marked in Step 4. • F/O AIRSPEED/MACH indicator increases to approximately 0.86 MACH.	No test.
13. When F/O AIRSPEED/MACH indicator reaches maximum (approximately 0.86 MACH) and stops, terminate DADC self test by depressing PUSH TO TEST for 1 second on DADC No. 2.	• Air data system No. 2 instrument Fail flags appear until system returns to ind prior to Step 11. • F/O AIRSPEED/MACH indicator returns to approximately 0.18 MACH. • MACH TRIM 2 and MACH FEEL 2 FAIL lights illuminate.	
	MACH TRIM 2 FAIL comes on, and Mach trim 2 system inoperative. Note MACH number.	Walk MACH TRIM 2 and MACH FEEL 2 down to minimum until they no longer fail. Repeat test. • If FAIL consistent at or near same MACH number, ADC pot noisy. Replace ADC No. 2.

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	MACH TRIM 2 FAIL comes on, and Mach trim 2 system inoperative.	Check trim aug computer FIM, if white: • Replace trim aug computer. Check ELEC FEEL & TRIM MECH FIM on FCES computer, if yellow: • Replace Mach trim motor No. 2. • Replace electrical pitch trim feel assembly. • Check wiring between trim aug computer and electrical pitch trim feel assembly (Ref. WDM 22-18-09, 22-18-10).
	Mach trim 2 system inoperative without FAIL light.	• Replace trim aug computer. • Replace ADC No. 2. • Check wiring between trim aug computer and ADC No. 2 (Ref. WDM 22-18-09, 22-18-10).
14. Walk MACH FEEL ind down to minimum MACH indication by depressing MACH FEEL 2 and MACH TRIM 2 to OFF when they FAIL, and then back on.	Continue walking until: • MACH FEEL 2 and MACH TRIM 2 do not FAIL. • Manual trim wheel stops moving at position marked in Step 10. • MACH FEEL ind stops at minimum MACH indication.	
15. Depress MACH TRIM 2 to OFF.		No test.

Mach Trim/Feel Fault Isolation
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	D. MACH FEEL SYSTEM TEST.	
R NOTE: For aircraft with airanalog Air Data Computer R installed in position 1, use the following Steps 1 R thru 5.		
1. Using tester, establish a speed of 0.4 MACH.		No test.
2. Depress MACH FEEL 1 to on.		No test.
3. Using tester, slowly increase speed to 0.9 MACH.	Flight control panel. • Ind. increases to approx. 0.9 MACH. Upper Mach feel sync shaft (Ref. Fig. 106) rotates 17 to 18-1/2 turns in HIGH SPEED direction.	Test OK.
	Mach indicator inop.	Meter points straight up. • Replace indicator.
	Rotation in HIGH SPEED direction out of tolerance.	Replace trim aug computer. Replace electrical pitch feel trim assembly.
4. Using tester, slowly decrease speed to 0.4 MACH.	Flight control panel. • Ind. decreases to approx. 0.4.	No test.
5. Depress MACH FEEL 1 to OFF.		No test.
R NOTE: For aircraft with an analog Air Data Computer R installed in position 1, use the following Steps 6 R thru 10.		

Mach Trim/Feel Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
6. Depress MACH FEEL 2 to on.		No test.
7. Using tester, slowly increase speed to 0.9 MACH.	Flight control panel. • Ind. increases to approx. 0.9 MACH. Upper Mach feel sync shaft (Ref. Fig. 106) rotates 17 to 18-1/2 turns in HIGH SPEED direction.	Test OK.
	Rotation in HIGH SPEED direction out of tolerance.	Replace trim aug computer. Replace electrical pitch feel trim assembly.
8. Using tester, decrease speed to 0.4 MACH.	Flight control panel. • Ind. decreases to approx. 0.4.	No test.
9. Depress all MACH FEEL and TRIM to on.		No test.
R 10. Disassemble test setup.		No test.
R NOTE: For aircraft with a digital Air Data Computer installed in position 1, use the following Steps 1 thru 6.		
R 1. Depress MACH FEEL 1 to on.		No test.
R 2. FESC DADC No. 1 • Depress PUSH TO TEST for 1 second and release.	• All air data system No. 1 instruments FAIL flags come into view. • MACH TRIM 1 FAIL light comes on • MACH FEEL 1 FAIL light comes on.	Test OK.
	DADC fails self test	Replace indicator or DADC No. 1.

R Mach Trim/Feel Fault Isolation (Cont)
R Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
3. When TEST IN PROGRESS light on DADC No. 1 starts to flash (approximately 10 seconds after start of self test in Step 2), depress PUSH TO TEST switch on DADC No. 1 for 1 second and release. • Reset MACH TRIM 1 and MACH FEEL 1 switchlights.	MACH FEEL MACH indicator slowly moves up scale to maximum. • Manual Pitch Trim Wheel starts to rotate nose-up and stops. • Mach Feel Sync Shaft rotates 17 to 18 1/2 turns in high speed direction. • Capt AIRSPEED/MACH indicator increases to approximately 0.86 MACH.	No test.
4. When Capt. AIRSPEED/MACH indicator reaches maximum (approximately 0.86 MACH) and stops, terminate DADC self test by depressing PUSH TO TEST for 1 second on DADC No. 1.	• Air data system No. 1 instrument FAIL flags appear until system returns to indication prior to Step 2. • Capt AIRSPEED/MACH indicator returns to approximately 0.18 MACH • MACH FEEL 1 and MACH TRIM 1 FAIL lights illuminate.	
	Mach indicator inop.	Meter points straight up. • Replace indicator.
	Rotation in HIGH SPEED direction out of tolerance.	Replace trim aug computer. Replace electrical pitch feel trim assembly.

R Mach Trim/Feel Fault Isolation (Cont)
R Table 102

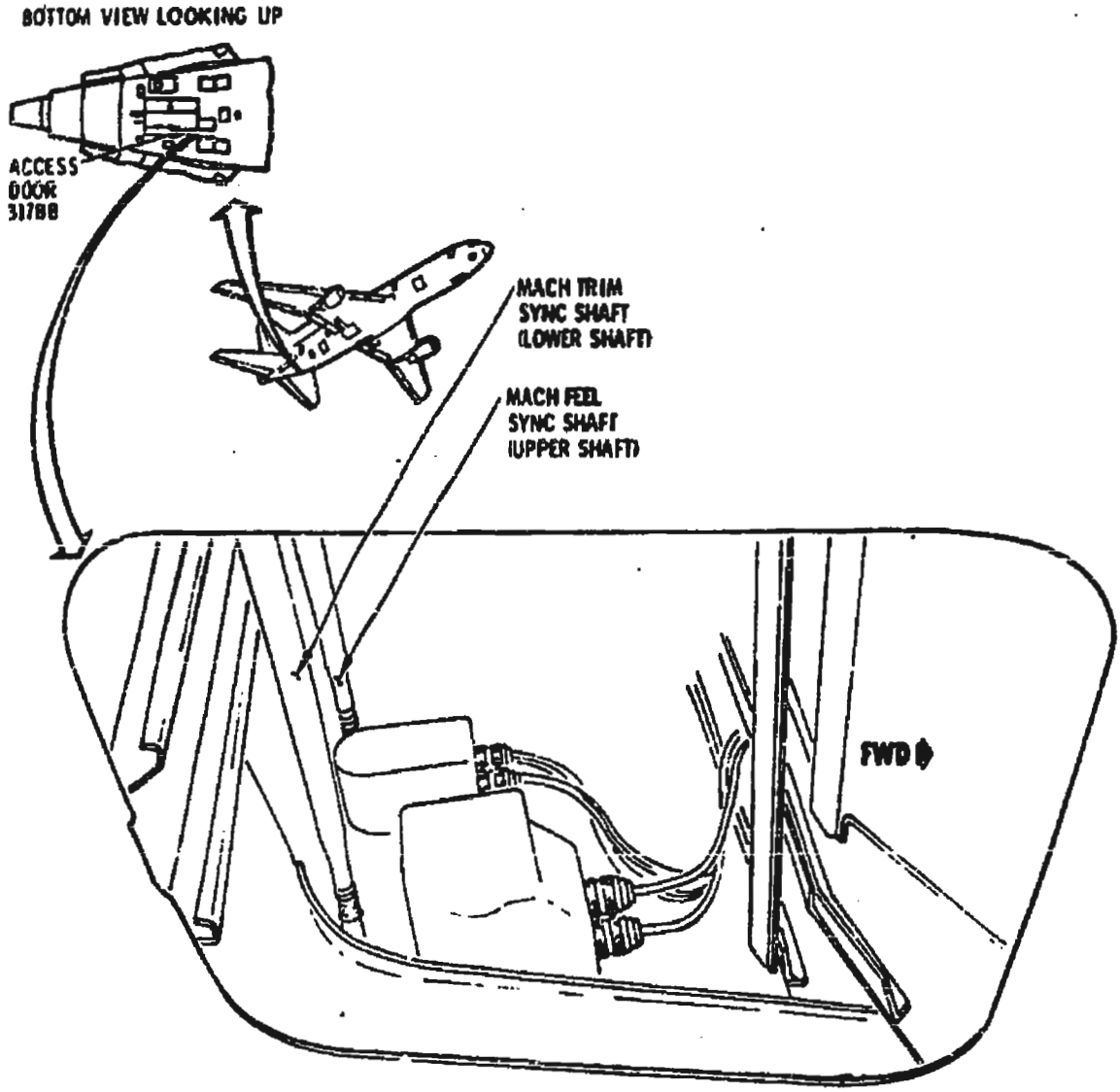
PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
5. Walk MACH FEEL MACH Ind down to minimum by depressing MACH FEEL 1 to OFF then on each time it fails until MACH FEEL 1 and MACH TRIM 1 no longer fail.	Flight control panel. • Ind. decreases to minimum.	No test.
6. Depress MACH FEEL 1 to OFF.		No test.
NOTE: For aircraft with a digital Air Data Computer installed in position 2, use the following Steps 7 thru 13.		
7. Depress MACH FEEL 2 to on.		No test.
8. FESC DADC No. 2 • Depress PUSH TO TEST for 1 second and release.	• All air data system No. 2 instruments FAIL flags come into view. • MACH TRIM 2 FAIL light comes on. • MACH FEEL 2 FAIL light comes on.	Test OK.
	DADC fails self test.	Replace indicator or DADC No. 2.

R Mach Trim/Feel Fault Isolation (Cont)
R Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
9. When TEST IN PROGRESS light on DADC No. 2 starts to flash (approximately 10 seconds after start of self test in Step 8), depress PUSH TO TEST switch on DADC No. 2 for 1 second and release. • Reset MACH TRIM 2 and MACH FEEL 2 switchlights.	MACH FEEL MACH Ind. slowly moves up scale to max. • Manual Pitch Trim Wheel starts to rotate nose-up and stops. • Mach Feel Sync Shaft rotates 17 to 18 1/2 turns in high speed direction. • F/O AIRSPEED/MACH indicator increases to approx. 0.86 MACH.	No test.
10. When F/O AIRSPEED/MACH indicator reaches maximum (approx. 0.86 MACH) and stops, terminate DADC self test by depressing PUSH TO TEST for 1 sec on DADC No. 2.	• Air data system No. 2 instrument FAIL flags appear until system returns to ind prior to Step 8. • F/O AIRSPEED/MACH indicator returns to approx. 0.18 MACH. • MACH TRIM 2 and MACH FEEL 2 FAIL lights come on	Test OK.
	Rotation in HIGH SPEED direction out of tolerance.	Replace trim aug computer. Replace electrical pitch feel trim assembly.

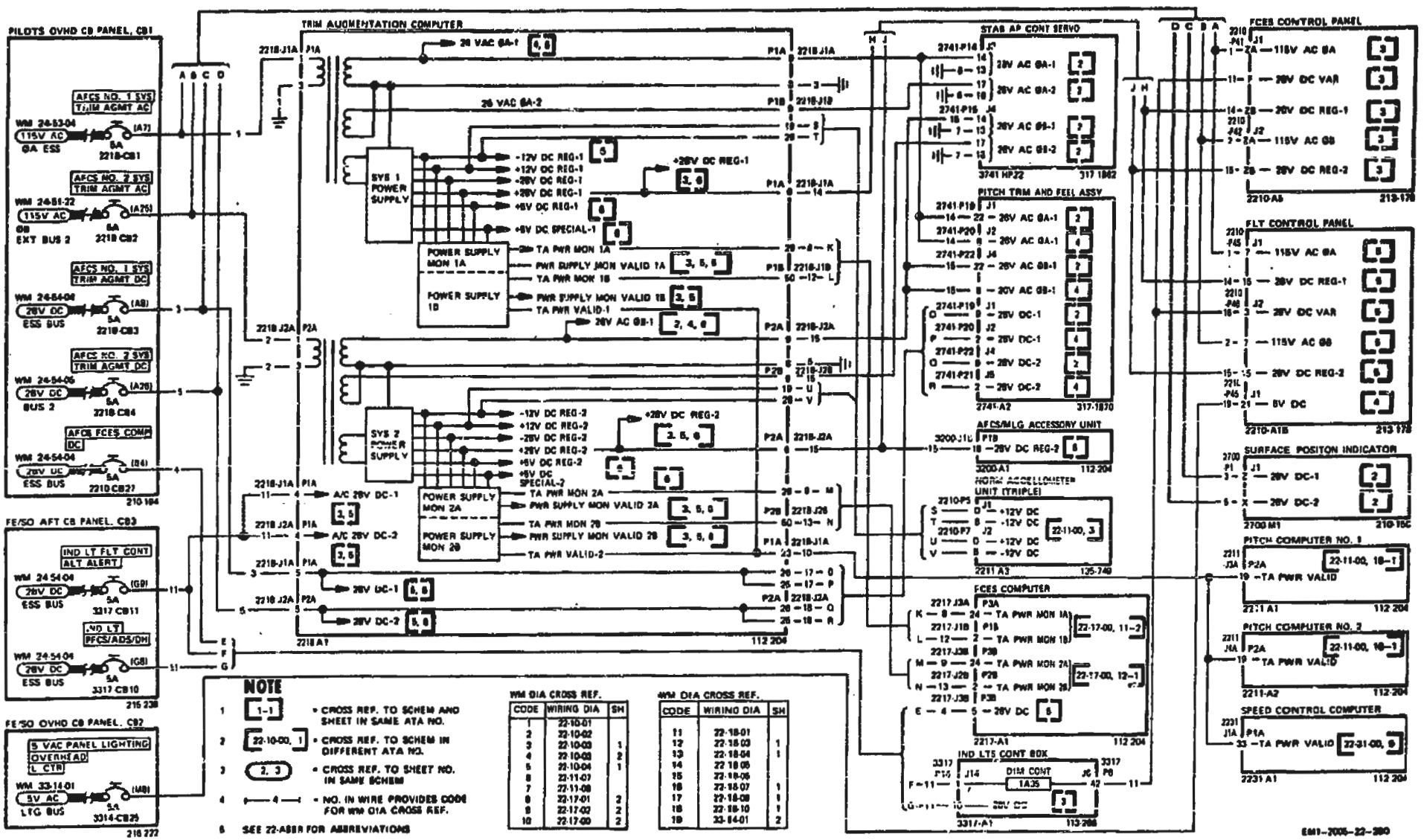
R Mach Trim/Feel Fault Isolation (Cont)
R Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
11. Walk MACH FEEL ind down to minimum MACH indication by depressing MACH FEEL 2 and MACH TRIM 2 to OFF when they FAIL, and then back on.	Continue walking until: • MACH FEEL 2 and MACH TRIM 2 do not FAIL. • Manual trim wheel stops moving. • MACH FEEL ind stops at minimum MACH indication.	
12. Depress all MACH FEEL and TRIM to on.		No test.
13. Disassemble test setup.		No test.



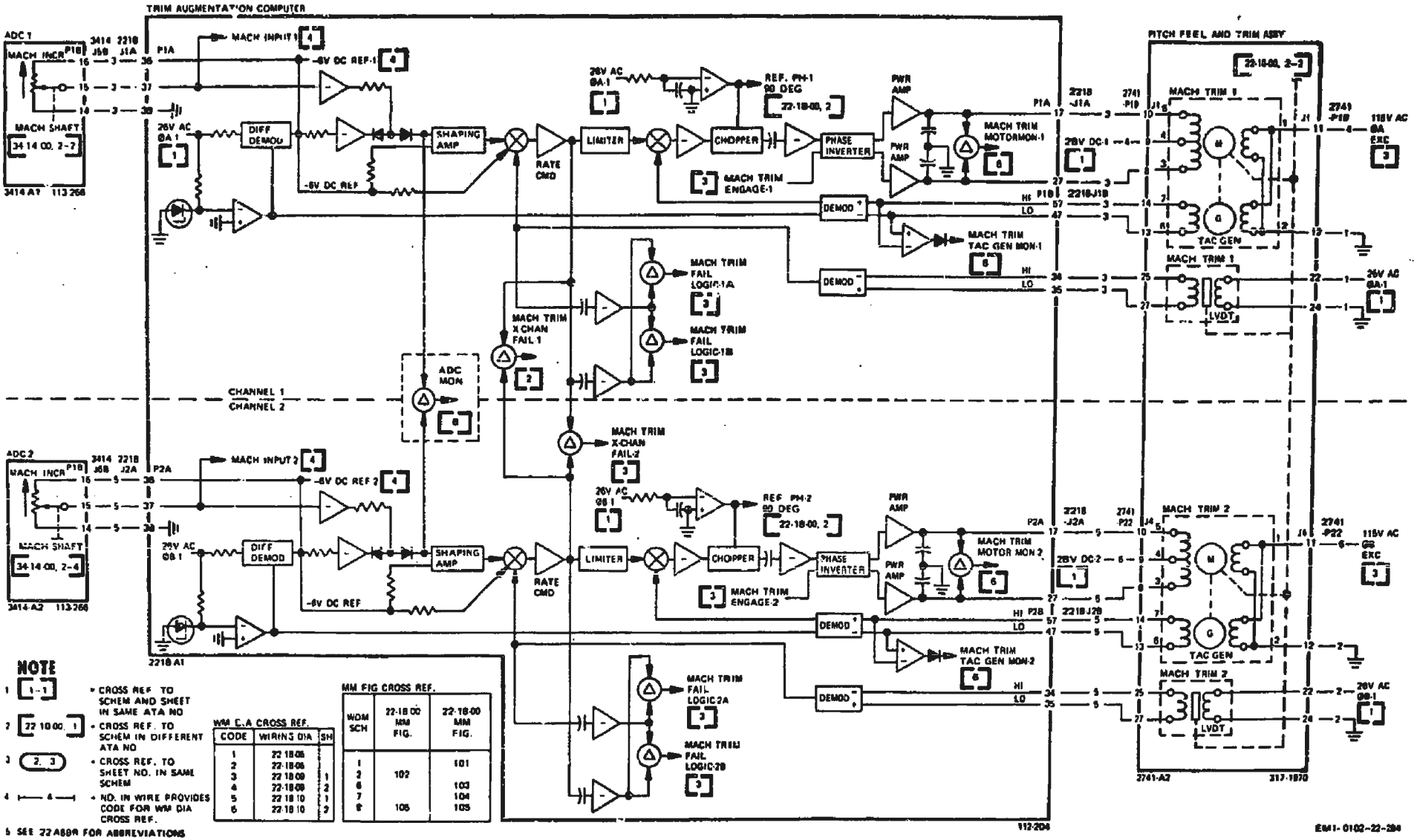
M1-0101-22-209

Upper Mach Feel Sync Shaft Location
Figure 106


PILOTS OVHD CB PANEL, CB1
AFCS NO. 1 SYS TRIM AGMT AC
AFCS NO. 2 SYS TRIM AGMT AC
AFCS NO. 1 SYS TRIM AGMT DC
AFCS NO. 2 SYS TRIM AGMT DC
AFDS FCES COMP DC
FE/SO AFT CB PANEL, CB3
IND LT FLT CONT ALT ALERT
IND LT PFCS/ADS/DH
FE/SO OVHD CB PANEL, CB2
5 VAC PANEL LIGHTING OVERHEAD L CTR
TRIM AUGMENTATION COMPUTER
SYS 1 POWER SUPPLY
SYS 2 POWER SUPPLY
POWER SUPPLY MON 1A
POWER SUPPLY 1B
POWER SUPPLY MON 2A
POWER SUPPLY MON 2B
STAB AP CONT SERVO
PITCH TRIM AND FEEL ASSY
AFCS/MLG ACCESSORY UNIT
NORM ACCELEROMETER UNIT (TRIPLE)
FCES COMPUTER
IND LTS CONT BOX
FCES CONTROL PANEL
FLT CONTROL PANEL
SURFACE POSITON INDICATOR
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
SPEED CONTROL COMPUTER
NOTE
WM DIA CROSS REF.
4WM DIA CROSS REF.
SEE 22-ABBR FOR ABBREVIATIONS
EM1-2005-22-280

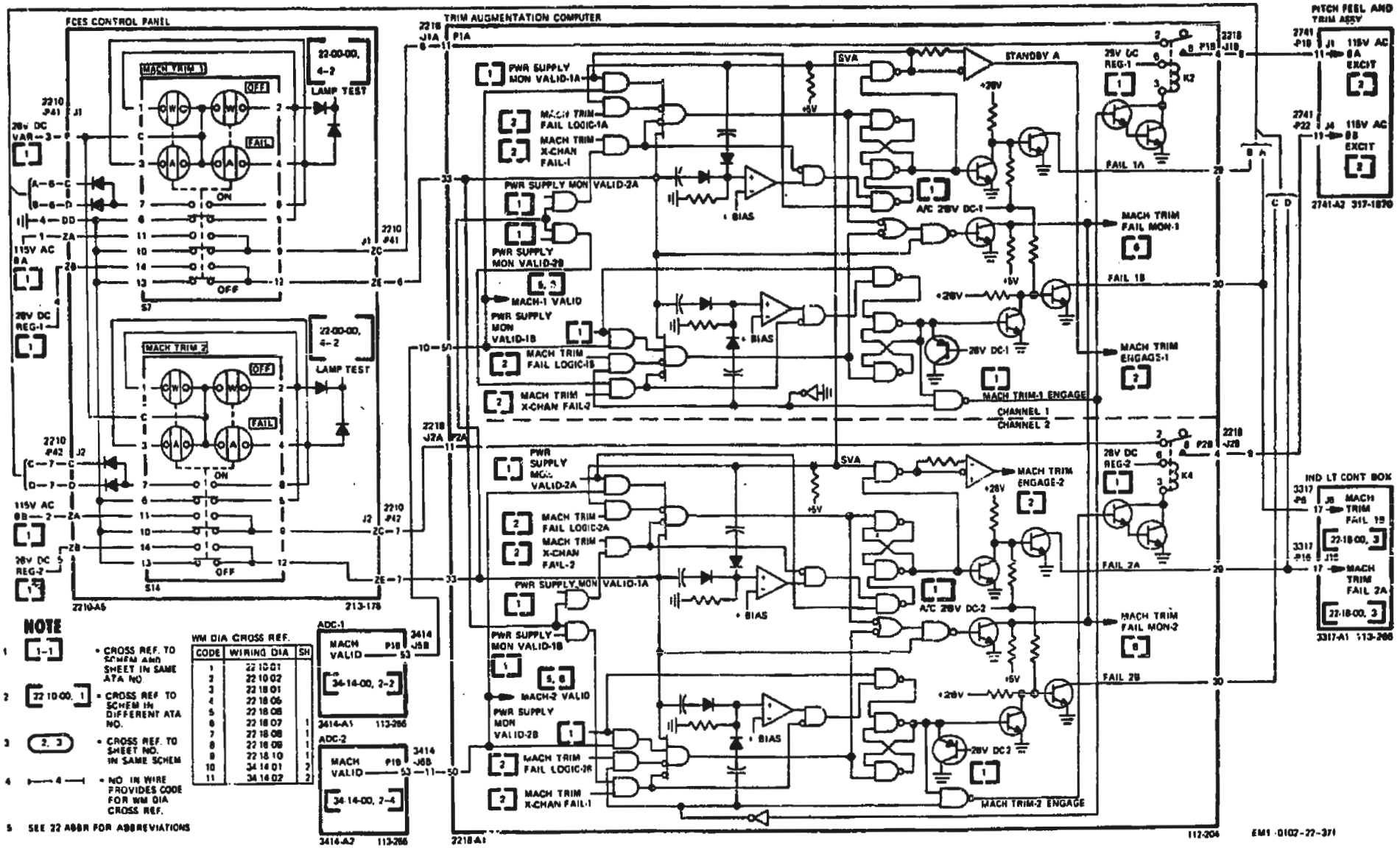
Trim Augmentation Computer Power Distribution Schematic
SCHEM 1

R EFFECTIVITY: ALL
R
001B



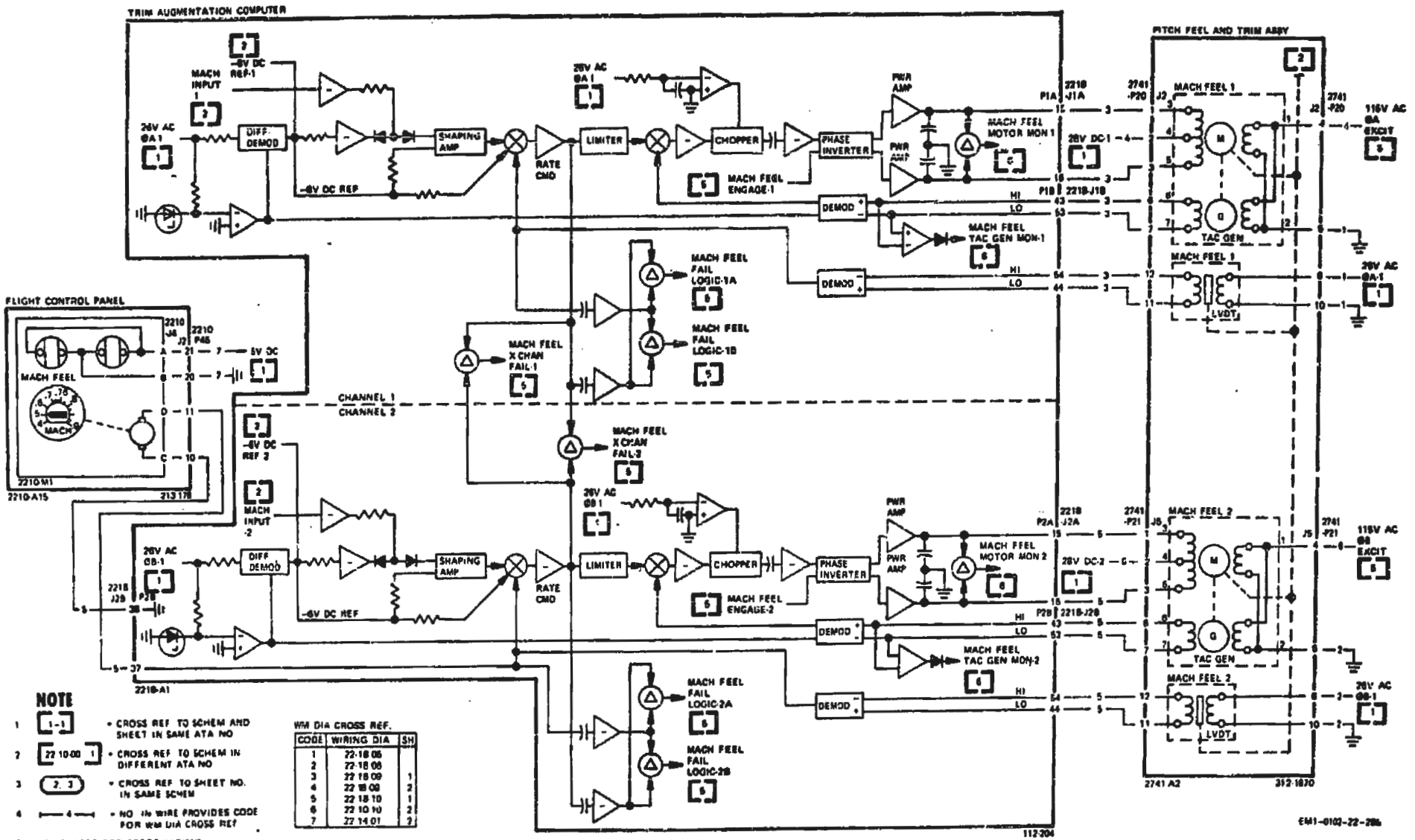
Mach Trim Signal Flow Schematic
SCHEM 2

R EFFECTIVITY: ALL
R
0018



Mach Trim Logic Schematic
SCHEM 3

R EFFECTIVITY: ALL
R
0018



NOTE

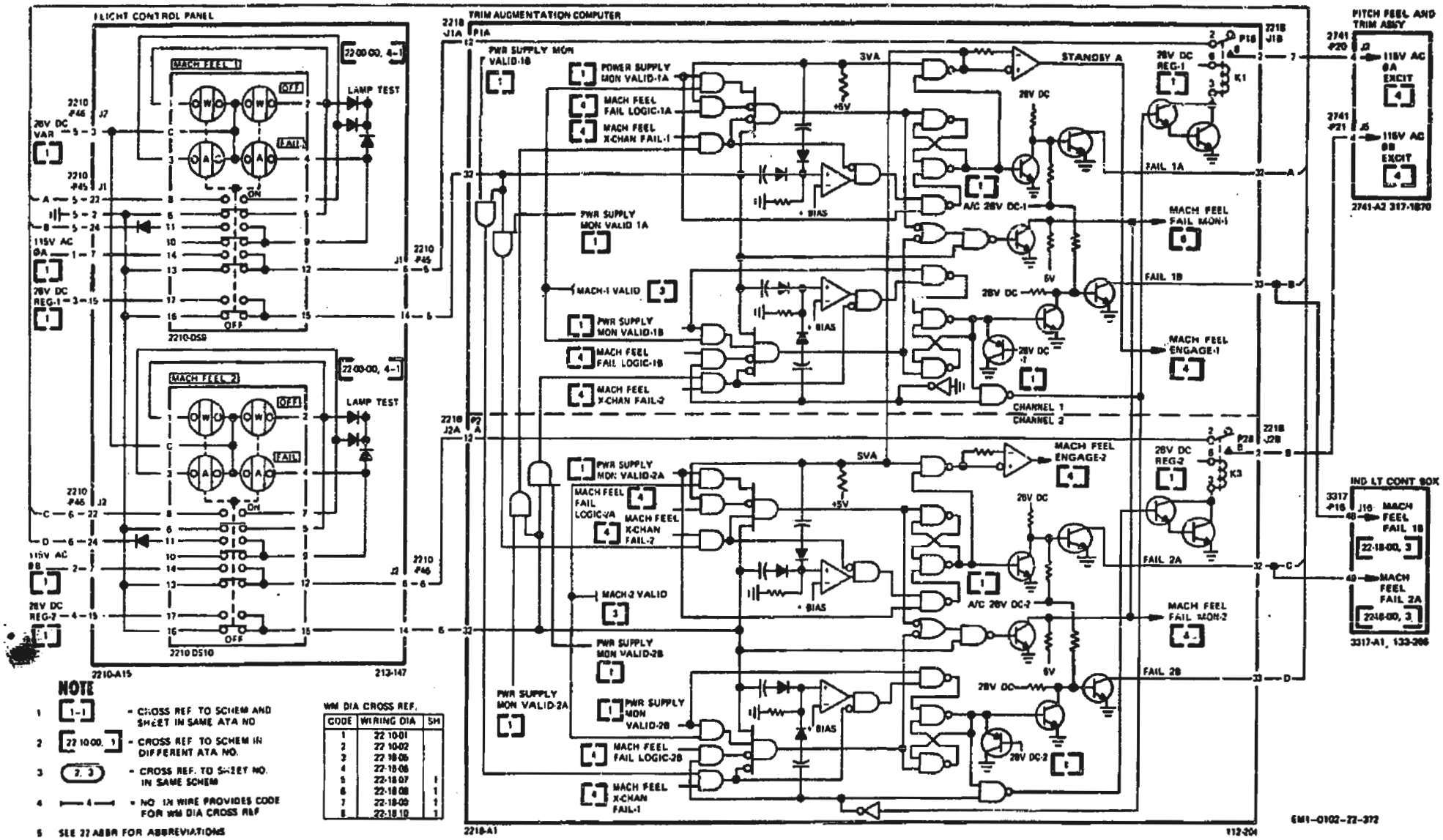
1. [1-1] • CROSS REF TO SCHEM AND SHEET IN SAME ATA NO
2. [22 10-00 1] • CROSS REF TO SCHEM IN DIFFERENT ATA NO
3. (2, 3) • CROSS REF TO SHEET NO. IN SAME SCHEM
4. —4— • NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5. SEE 22 ABBR FOR ABBREVIATIONS

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-18 05	
2	22-18 06	
3	22 18 09	1
4	22 18 00	2
5	22 18 10	1
6	22 10 10	2
7	22 14 01	2

Mach Feel Signal Flow Schematic
SCHEM 4

R EFFECTIVITY: ALL
R
0018



NOTE

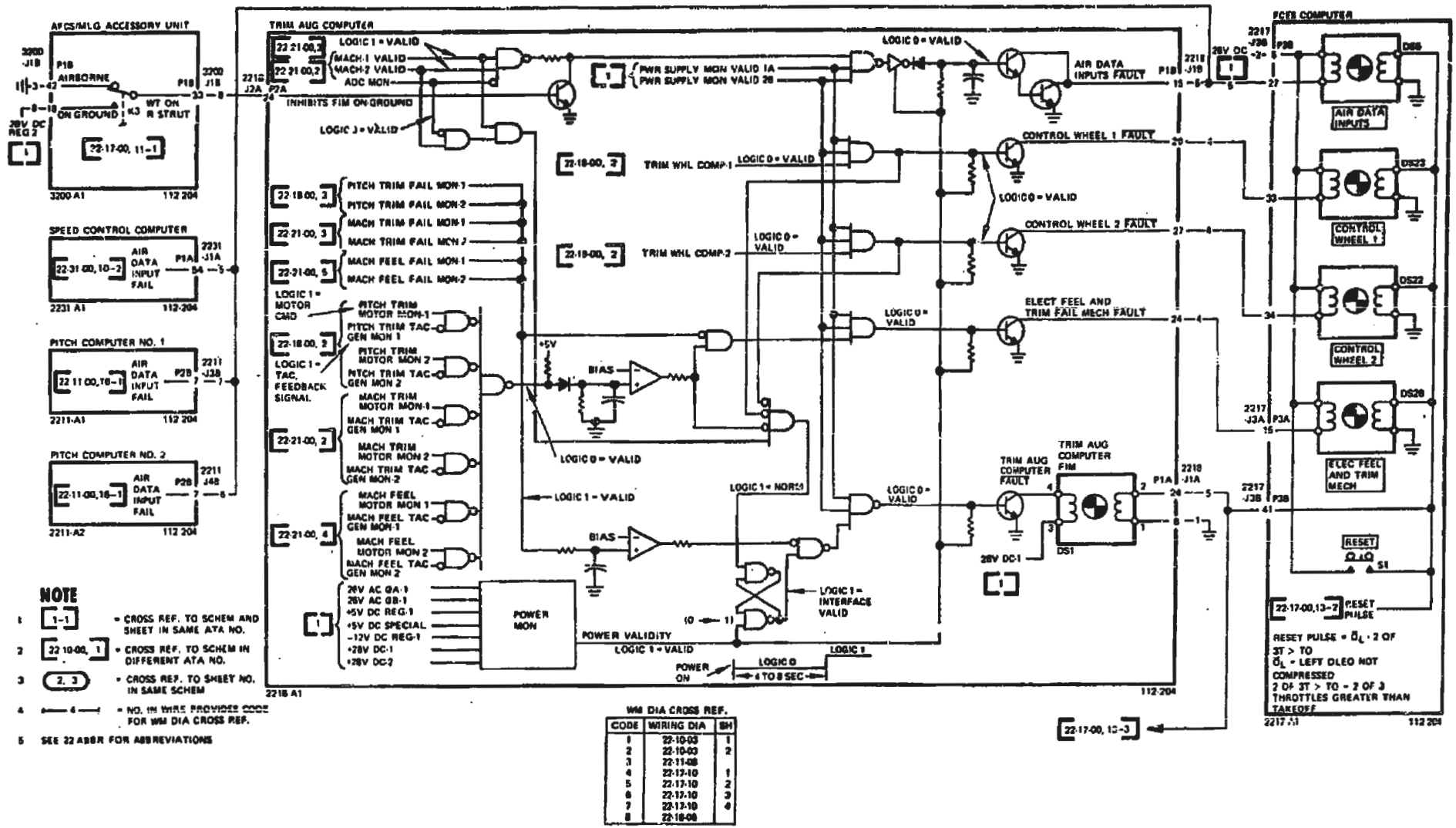
1. [1-1] - CROSS REF TO SCHEM AND SHEET IN SAME ATA NO
2. [22 10 00, 1] - CROSS REF TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— - NO IN WIRE PROVIDES CODE FOR WM DIA CROSS REF
5. SEE 22 ABBR FOR ABBREVIATIONS

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22 10-01	
2	22 10-02	
3	22 18-05	
4	22-18-06	
5	22-18-07	1
6	22-18-08	1
7	22-18-09	1
8	22-18-10	1

Mach Feel Logic Schematic
SCHEM 5

R EFFECTIVITY: ALL
R
001a


AFCS/MLG ACCESSORY UNIT
AIRBORNE
ON GROUND
WT ON R STRUT
TRIM AUG COMPUTER
INHIBITS FIM ON GROUND
SPEED CONTROL COMPUTER
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
AIR DATA INPUT FAIL
POWER MON
POWER VALIDITY
LOGIC 1 = INTERFACE VALID
TRIM AUG COMPUTER FAULT
TRIM AUG COMPUTER FIM
AIR DATA INPUTS FAULT
CONTROL WHEEL 1 FAULT
CONTROL WHEEL 2 FAULT
ELECT FEEL AND TRIM FAIL MECH FAULT
RESET
RESET PULSE
FCES COMPUTER
AIR DATA INPUTS
CONTROL WHEEL 1
CONTROL WHEEL 2
ELEC FEEL AND TRIM MECH
NOTE
1 1-1 = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 22 10-00, 1 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 2, 3 = CROSS REF. TO SHEET NO. IN SAME SCHEM
4 4 = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 SEE 22 ABBR FOR ABBREVIATIONS

WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-10-03	1
2	22-10-03	2
3	22-11-08	
4	22-12-10	1
5	22-12-10	2
6	22-12-10	3
7	22-12-10	4
8	22-16-08	

EM1-2004-22-288

Trim Augmentation Computer FIM Schematic
SCHEM 6

R
R
0018 EFFECTIVITY: ALL

R MACH TRIM AND FEEL SYSTEMS - ADJUSTMENT AND TEST

R 1. Equipment and Materials

CR None

2. Referenced Procedures

C	21-00-00	Air Conditioning System - Maintenance Practices
	24-00-00	Electrical Power - Maintenance Practices
C	27-11-00	Aileron Control System - Adjustment and Test
	29-11-00	Hydraulic Power System - Maintenance Practices
C	32-63-00	Air/Ground Sensing System - Maintenance Practices
	34-13-00	Pitot Static System - Adjustment and Test
	34-14-00	Central Air Data Computer System - Maintenance Practices

3. Adjustment/Test

The Mach trim and feel operational test provided below requires that all associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

C (2) Verify that avionics cooling is on (Ref. 21-00-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

CR (3) Turn on hydraulic power (Ref. 29-11-00).

CR R (4) On pilots overhead circuit breaker panel CB1, zone 210, verify that following circuit breakers are closed:

All circuit breakers on AVIONIC FLIGHT CONTROL SYSTEM strips

26 VAC NAV EXCITATION

ALT ALERT-1 (K27)

ALT ALERT-2 (J21)

R On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that following circuit breakers are closed:

FLIGHT STATION MISC

R AOA (F1)

STICK SHAKE (F2)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

B. Mach Trim and Mach Feel Operational Test

R NOTE: The Mach trim and feel operational tests require a second technician in forward electronic service center.

(1) Verify that central air data computer system is on (Ref. 34-14-00).

C C C C C (2) Set MACH TRIM 1 (on FCES control panel) and MACH FEEL 1 (on flight control panel) switch lights to ON (indicators dark). Set MACH TRIM 2 (on FCES CONTROL PANEL) and MACH FEEL 2 (on flight control panel) switch lights to OFF (indicator illuminated).

C C C C NOTE: It may be necessary to cycle MACH TRIM and/or MACH FEEL switch light several times to turn off FAIL annunciations that may have been tripped by previous operations or unit changes.

C CR CR CR (3) Use pitch trim thumb wheel on either control wheel to run the pitch trim wheel to 0 degrees as indicated on manual pitch trim wheel. Verify that the MACH FEEL indicator reads approximately .45.

CR (4) On analog (if installed) air data computer (ADC) No. 1 CR located in forward electronic service center, push and CR hold SELF TEST button. Monitor the Mach meter and wait CR until a steady reading is obtained and Mach fail flag CR disappears.

CR On digital (if installed) air data computer (ADC) NO. 1 CR located in forward electronic service center, push and CR hold SELF TEST button for at least one second but not CR more than 10 seconds. Note that TEST IN PROGRESS light CR comes on. In approximately 10 to 15 seconds, the TEST CR IN PROGRESS light will flash. AGAIN push and hold SELF CR TEST button for at least one second but not more than CR 10 seconds. Note that TEST IN PROGRESS light comes on CR steady indicating SLEW TEST is in progress. Monitor CR the Mach Meter and in about 2 minutes, when the Mach CR meter reads approximately .86 mach, push and hold SELF CR TEST button.

CR (a) Check that Mach Feel 1 and Mach Trim 1 systems CR fail.

CR (b) Reset No. 1 mach trim and No. 1 mach feel switch C to dark. Pitch wheel will move in up direction C and mach feel indicator will move clockwise. When C wheel stops moving and indicator stops a fail will C show on switches. Press switch again on mach trim C and mach feel to dark. Same results will occur. C Continue doing this until lights no longer fail C (approximately five times). Check that mach feel CR indicator reads approximately same as mach meter C and that manual pitch wheel has rotated C approximately 1 1/4 units (about a 300 degree C rotation of wheel).

C (5) Release self test button on ADC. The mach flag on C pilots mach indicator will drop.

C (6) Allow CADC test to complete then mach flag should C disappear.

C (7) Push mach trim and mach feel switches until they no C longer fail and stay dark. Verify that pitch trim C wheel has returned to zero and mach feel indicator to C approximately 0.45.

C (8) Set MACH TRIM 1 (on FCES control panel) and MACH FEEL 1 C (on flight control panel) switch lights to OFF C (indicator illuminated). Set MACH TRIM 2 (on FCES C control panel) and MACH FEEL 2 (on flight control C panel) switch lights to ON (indicator dark).

C (9) Repeat Steps (3) through (7) using No. 2 CADC.

C NOTE: Both No. 1 and No. 2 mach trim/mach feel systems
C may be checked simultaneously by pushing and
C holding both CADC self test buttons and then
C alternately switching No. 1 and No. 2 channels
C to on (dark) to obtain operation of trim wheel
C and mach feel indicator.

C (10) Reset load relief system (LRS) computer.

C. Test Completion

C (1) In FESC,center rack, set LRS computer BITE switch to RESET for 5 seconds then return to RUN. Verify that ADC fail indicator on LRS computer has reset (BLACK).

C (2) Turn off hydraulic power (Ref. 29-11-00).

(3) Turn off electrical power (Ref. 24-00-00).

MACH TRIM MOTOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, MS20995C20, or equivalent

2. Referenced Procedures

22-21-01 Mach Trim Motor - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - TRIM AGMT - AC(A7) and AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - TRIM AGMT - AC (A25).

(2) Open horizontal stabilizer actuators access door 317BB.

(3) Remove screws, washers, and cover from electrical trim actuator assembly (Ref. Fig. 401).

(4) Remove nuts from connector for Mach trim motor.

(5) Remove connector from motor and push aside.

(6) Remove screws and motor mount cleats securing motor-generator to mounting plate. Lift motor-generator clear of mounting plate.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Install motor (Ref. Fig. 401) on mounting plate. Ensure proper mesh of motor gear. Attach motor to mounting plate with screws and motor mount cleats. Torque screws 5 to 10 lb in., and lock-wire screws using single-wire method.

CR
CR NOTE: Tri-Wing mount screws can be replaced by NAS1352-D6H6P Socket Head Screws.

(3) Install connector on motor.

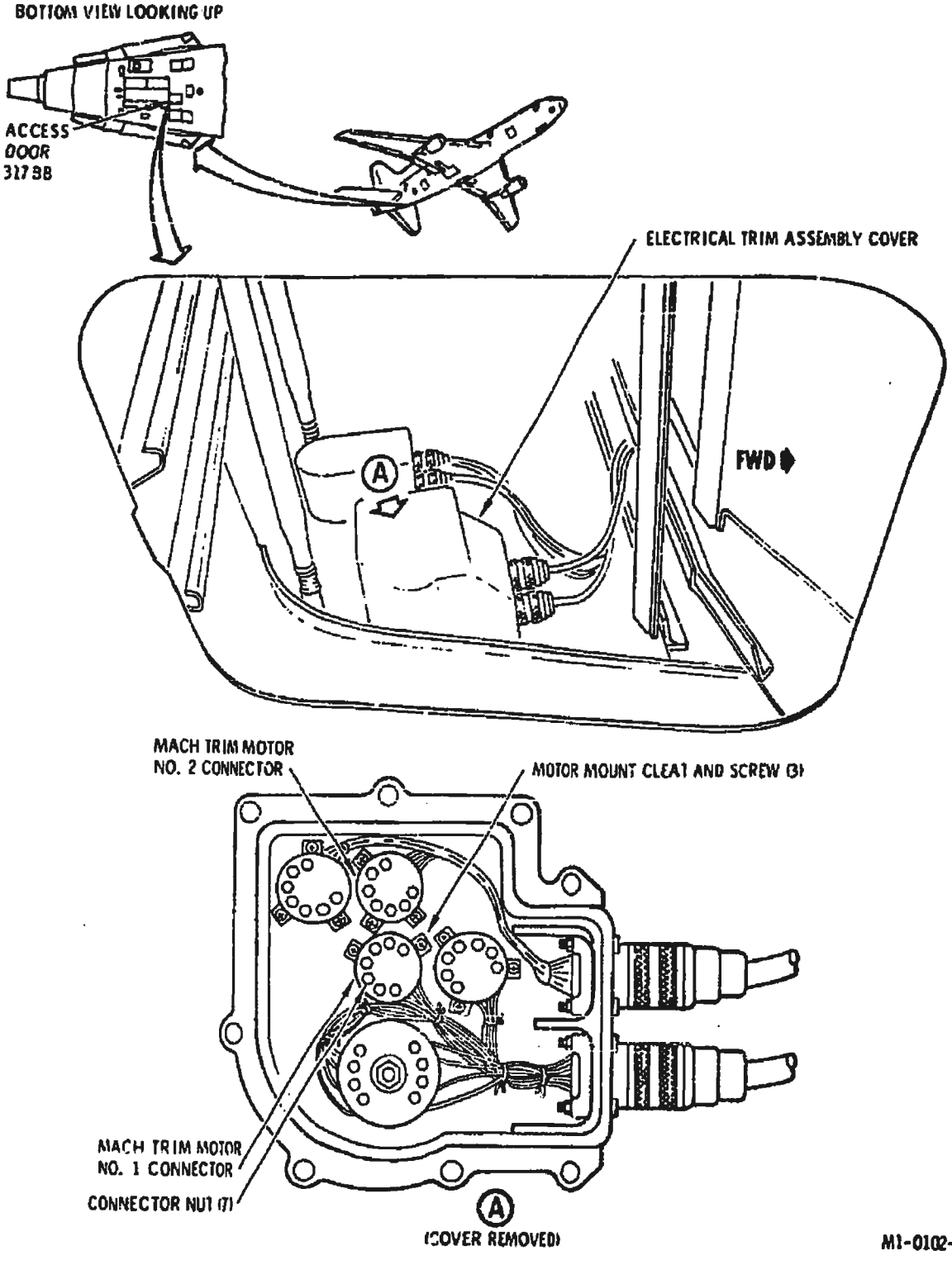
(4) Secure connector with nuts, and torque nuts 1 to 2 lb in.

(5) Install cover and secure with washers and screws. Torque screws 15 to 20 lb in. Lock-wire screws using single-wire method.

(6) Close access door.

(7) Remove tags and close circuit breakers opened in Step 3A(1).

C C (8) Perform mach trim and mach feel operational/test (Ref. 22-21-00, page 502).



R Mach Trim Motor - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

MACH TRIM MOTOR - ADJUSTMENT AND TEST

1. General

There are two mach trim motors in the mach trim system. Testing of a trim motor requires that only the associated systems be turned on, No. 1 systems for trim motor No. 1, and No. 2 systems for trim motor No. 2. The functional test procedure applies to both mach trim motors with mach trim motor No. 2 requirements provided in brackets, [ ].

2. Equipment and Materials

R Pitot-Static field tester, Type MB-1; or Pitot/Static Tester
R Burton 2024B, or equivalent (2 required).

3. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
34-13-00	Pitot-Static System Leak Test - Adjustment and Test
34-14-00	Central Air Data Computer System - Maintenance Practices

4. Adjustment/Test

The functional test requires two technicians, one in the flight station and another in the forward electronics service center, with the service interphone system operating.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

R (4) Connect tester to CADC system No. 1 (No. 2) (Ref. 34-13-00).

(5) Verify that central air data computer system No. 1 [No. 2] is on (Ref. 34-14-00).

(6) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS [NO. 2 SYSTEMS]

TRIM AGMT - AC (A7) [A25]

TRIM AGMT - DC (A8) [A26]

On Flight Engineer/Second Officer overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

STABILIZER SERVO

LB (H16)

RC (H17)

LA (H18)

RD (H19)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

B. Functional Test

R (1) On FCES control panel, set both MACH TRIM switchlights
R to on (dark).

R (2) Depress MACH TRIM 2 [MACH TRIM 1] switchlight to OFF.

R (3) Set manual PITCH TRIM WHEEL to mid-range (stabilizer
R surface position indicator at 5°).

R (4) On air data tester, establish an altitude of
R approximately 30,000 feet, and a speed of 0.5 mach, as
R indicated on the Captains [First Officers] AS/MACH
R indicator.

R NOTE: Insert speed change slowly. (Excessive mach
R rate may cause MACH TRIM FAIL annunciation.)

R (5) On air data tester, increase mach number to 0.9 and
R verify that control column displaces aft.

R NOTE: No control column displacement will occur until
R after mach 0.55 is reached.

R (6) Decrease mach number to 0.5 and verify that control
R column returns to original position.

R (7) While holding PITCH TRIM WHEEL, increase mach number
R toward 0.9 and verify that oscillations can be felt in
R the PITCH TRIM WHEEL.

R C. Test Completion

R (1) Turn off hydraulic power (Ref. 29-11-00).

R (2) Remove air data tester (Ref. 34-13-00).

R (3) In FESC, center rack, set LRS computer BITE switch to
R RESET for 5 seconds then return to RUN. Verify that
R CADC fail indicator on LRS computer has reset (BLACK).

R (4) Turn off electrical power (Ref. 24-00-00).

MACH FEEL SCHEDULE MOTOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Lock-wire, MS20995C20, or equivalent

2. Referenced Procedures

22-21-01 Mach Feel Schedule Motor - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 21U, open and tag circuit breakers AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - TRIM AGMT - AC(A7) and AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - TRIM AGMT - AC (A25).

(2) Open horizontal stabilizer actuators access door 317BB.

(3) Remove screws, washers, and cover from electrical feel programer actuator assembly (Ref. Fig. 401).

(4) Remove nuts from connector for Mach feel motor.

(5) Remove connector from motor and push aside.

(6) Remove screws and motor mount cleats securing motor to main housing. Lift motor clear of main housing.

C
C NOTE: An A01892-1 motor mount clip may be used instead of cleats.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Install motor (Ref. Fig. 401) on main housing. Ensure proper mesh of motor gear. Secure motor with screws and motor mount cleats. Torque Screws 5 to 10 lb in. Lock-wire screws using single-wire method.

CR NOTE: If motor guide pin does not mate properly with
CR the hole in the main housing, the common gear
CR drive between the motors will bind. BOTH MACH
CR FEEL SYSTEMS WILL FAIL WHEN TESTED. After
CR tightening motor screws manually, turn the mach
CR schedule coupler shaft (upper shaft, see Fig.
CR 401). It should turn freely. If not, loosen
CR motor screws and reseat motor to ensure proper
CR guide pin mate.

C Tri-Wing mount screws can be replaced by
C NAS1352-D6H6P Socket Head Screws.

(3) Install connector on motor-generator.

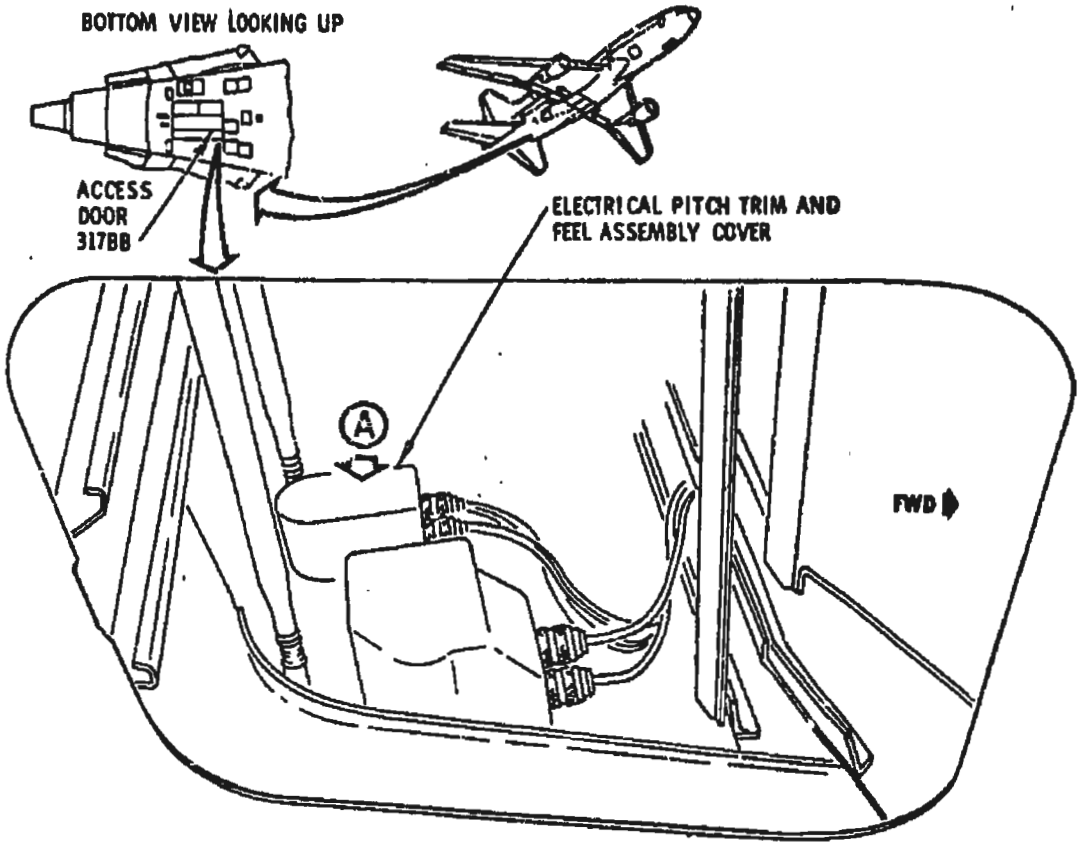
(4) Secure connector with nuts, and torque nuts 1 to 2 lb in.

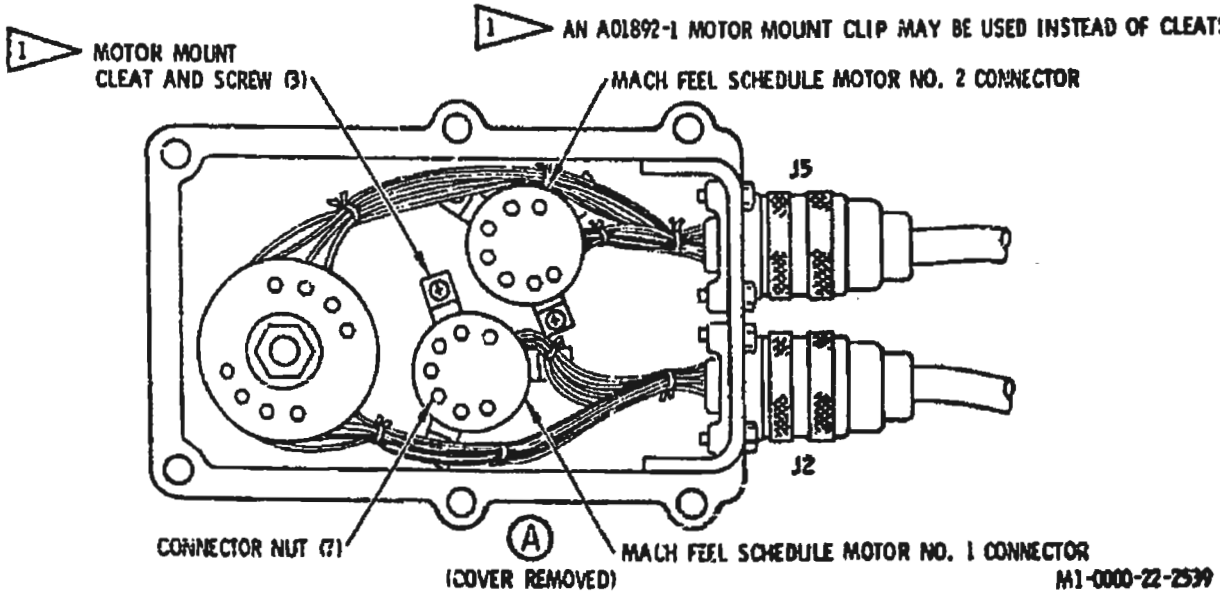
(5) Install cover and secure with washers and screws. Torque screws 5 to 10 lb in. Lock-wire screws using single-wire method.

(6) Close access door.

(7) Remove tags and close circuit breakers opened in Step 3A(1).

C (8) Perform mach trim and feel operational/test. (Ref.
C 22-21-00, Page 502).




1 MOTOR MOUNT CLEAT AND SCREW (3)
1 AN A01892-1 MOTOR MOUNT CLIP MAY BE USED INSTEAD OF CLEATS.
MACH FEEL SCHEDULE MOTOR NO. 2 CONNECTOR
J5
J2
CONNECTOR NUT (7)
A
(COVER REMOVED)
MACH FEEL SCHEDULE MOTOR NO. 1 CONNECTOR
M1-0000-22-2539

CR
CR

Mach Feel Schedule Motor - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

MACH FEEL SCHEDULE MOTOR - ADJUSTMENT AND TEST

1. Referenced Procedures

	21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
	24-00-00	Electrical Power - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices
R	34-14-00	Air Data Computer System - Adjustment and Test

2. Equipment and Materials

Type MB-1 Pilot/Static Field Tester, Burton 2024B Pitot/Static Tester; or equivalent (2 req.).

3. Adjustment/Test

The Mach feel schedule motor operational test provided below requires that all other autoflight system components and associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that equipment cooling is on (Ref. 21-25-00).

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(3) Turn on hydraulic power (Ref. 29-11-00).

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

NO. 1 SYSTEMS (or NO. 2 SYSTEMS)

TRIM AGMT - AC

TRIM AGMT - DC

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT/ALT ALERT is closed.

B. Mach Feel Schedule Motor Operational Test

WARNING: The Mach feel motor operational test requires a second technician in the forward electronic service center.

R (1) Verify that air data computer (ADC) system is on (Ref. 34-14-00).

R (2) On FCES control panel, depress MACH TRIM 1 and 2 to on.

R (3) On flight control panel, depress MACH FEEL 1 and 2 to
R on.

R (4) On ADC No. 1 depress TEST switch for duration of step
R (if analog ADC) or for one second (if digital ADC).
R MACH TRIM 1 and MACH FEEL 1 switchlights indicate FAIL.

R (5) On ADC No. 2, depress TEST switch for duration of step
R (if analog ADC) or for one second (if digital ADC).
R MACH TRIM 2 and MACH FEEL 2 switchlights indicate FAIL.

R (6) Depress both MACH TRIM and both MACH FEEL switchlights
R to OFF.

R (7) Depress both MACH TRIM and both MACH FEEL switchlights
R to on.

R (8) Connect testers to ADC systems No. 1 and 2 (Ref. 34-13-00). On each tester, establish an altitude of 30,000 feet and a speed of 0.5 Mach, as indicated on Captains and First Officers AS/MACH indicators.

(9) Depress MACH TRIM 2 and MACH FEEL 2 switchlights to OFF.

(10) Set manual PITCH TRIM WHEEL to mid-range.

(11) Displace either control column and note force required.

NOTE: Insert Speed changes slowly. Excessive rate of change may cause FAIL annunciations.

(12) Using both testers, increase speed to MACH 0.9 as indicated on AS/MACH indicators. Verify that control column displaces aft as MACH is increased.

(13) On flight control panel, verify that MACH FEEL meter indicates 0.9 (±0.1) MACH.

(14) Displace either control column. Verify that force required has increased from that noted in Step G(11).

(15) Using both testers decrease speed to Mach 0.5. Verify that control column displaces forward as Mach is decreased.

(16) Depress MACH TRIM 2 and MACH FEEL 2 switchlights to on.

(17) Depress MACH TRIM 1 and MACH FEEL 1 switchlights to OFF.

(18) Using both testers, increase speed to Mach 0.9 as indicated on AS/MACH indicators. Verify that control column displaces aft as Mach is increased.

(19) On flight control panel, verify that MACH FEEL meter indicates 0.9 (±0.1) MACH.

(20) Displace either control column. Verify that force required has increased from that noted in Step G(11).

(21) Using both testers, decrease speed to Mach 0.5. Verify that control column displaces forward as Mach is decreased.

C. Test Completion

R (1) Disconnect testers from ADC systems No. 1 and 2 (Ref. 34-13-00).

(2) IN FESC, center rack, set LRS computer BITE switch to
R RESET for 5 seconds then return to RUN. Verify that
R ADC fail indicator on LRS computer has reset (BLACK).

(3) Turn off hydraulic power (Ref. 29-11-00).

(4) Turn off electrical power (Ref. 24-00-00).

AUTOTHROTTLE - DESCRIPTION AND OPERATION

1. General

Autothrottle is that portion of the AFCS that automatically controls the position of the throttles to properly blend engine
R power with flap position and aircraft pitch attitude during
R landing/approach. Autothrottle is included in the speed control system. The speed control system is a 2-channel, fail-passive system. Dual inputs are processed and compared to provide
R commands for automatic throttle operation. It provides throttle
R control to hold a selected airspeed and a minimum approach speed
R of 1.3 times the stall speed.

R The go-around mode provides vertical guidance and fast/slow
R commands to rapidly and safely arrest the aircrafts descent rate
R as well as to produce a climb rate commensurate with the
R aircrafts speed and pitch attitude. Wings level commands are
R provided for roll axis control in this mode. Selection of the
R go-around mode automatically releases all other modes except
R turbulence.

R Takeoff mode (a flight director mode only) provides flight
R director pitch and fast/slow displays for an optimum takeoff and
R climbout maneuver with wings level commands for roll axis
R control. The pitch and speed control laws and reference
R displays are the same as used for go-around mode.

R The automatic throttle commands drive the autothrottle servo and
R the attitude director indicator (ADI) slow-fast indicator. The
R takeoff/go-around commands are provided to the autopilot flight
R director system (APFDS) and the ADI slow-fast indicator.

R The speed control system is covered in Speed Control System
R (Ref. 22-31-00).

SPEED CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General

The speed control system is a dual-channel system which provides autothrottle mode, and takeoff/go-around mode computations.

The autothrottle mode computations control the engine throttles through the autothrottle servo drive assembly to maintain a selected airspeed or a computed angle-of-attack which corresponds to a stall margin airspeed. In the cruise configuration, the normal mode of autothrottle operation is the airspeed select mode. In the AUTOLAND configuration, autothrottle is operated in the stall margin mode. At the flare altitude, autothrottle switches to the flare mode which provides automatic closed-loop throttle retard before touchdown. At touchdown, autothrottle switches to the touchdown mode and the throttles are driven to idle and autothrottle automatically disengages.

The takeoff/go-around mode computations provide pitch axis commands for takeoff and go-around maneuvers. The computed command is sent to the autopilot flight director system pitch axis channels to be processed as the pitch command to the stabilizer autopilot servo or the flight director steering command.

In all phases of the autothrottle, and takeoff/go-around, the speed control system performance is monitored on the attitude director indicator (ADI).

The speed control system is comprised of the following components (Ref. Fig. 1):

Dual channel speed control computer located on the third shelf of the center rack in the forward electronics service center, zone 112

Autothrottle servo drive assembly consisting of the autothrottle servo, a gearbox, and three clutch assemblies located near the ceiling in the forward electronics service center, zone 112, below the pilots engine power controls

Angle-of-attack (alpha) sensors installed on the left and right sides, zone 112

Longitudinal accelerometer unit mounted above the galley ceiling, zone 135

Engine power control position switches (12) located below the autothrottle clutch assemblies, zone 112

THRUST select panel mounted on the flight station glareshield, zone 210

Autothrottle disengage switches mounted on the outboard sides of the engine power control lever handles, zones 211 and 212

Takeoff/go-around select switches on the outboard horns of the Captains and First Officers control wheels, zones 211 and 212

R FCES control panel (Ref. 22-10-00) mounted on the pilots overhead panel, zone 210

R AFCS MODES annunciator indicators (Ref. 22-10-00) on the Captains and First Officers instrument panels, zones 211 and 212

R AFCS WARNING indicators (Ref. 22-10-00) on the Captains and First Officers instrument panels, zones 211 and 212

In addition to the speed control system components, the system
R uses inputs from the normal accelerometer unit (Ref. 22-11-00)
R and FCES computer (Ref. 22-17-00). The normal accelerometer provides the vertical acceleration computation required for autothrottle stall margin mode computation. The FCES computer provides main landing gear weight-on-wheels and truck tilt information to set the system air/ground logic.

The interface between the speed control system components and the associated equipment required for operation is shown in Figure 2.

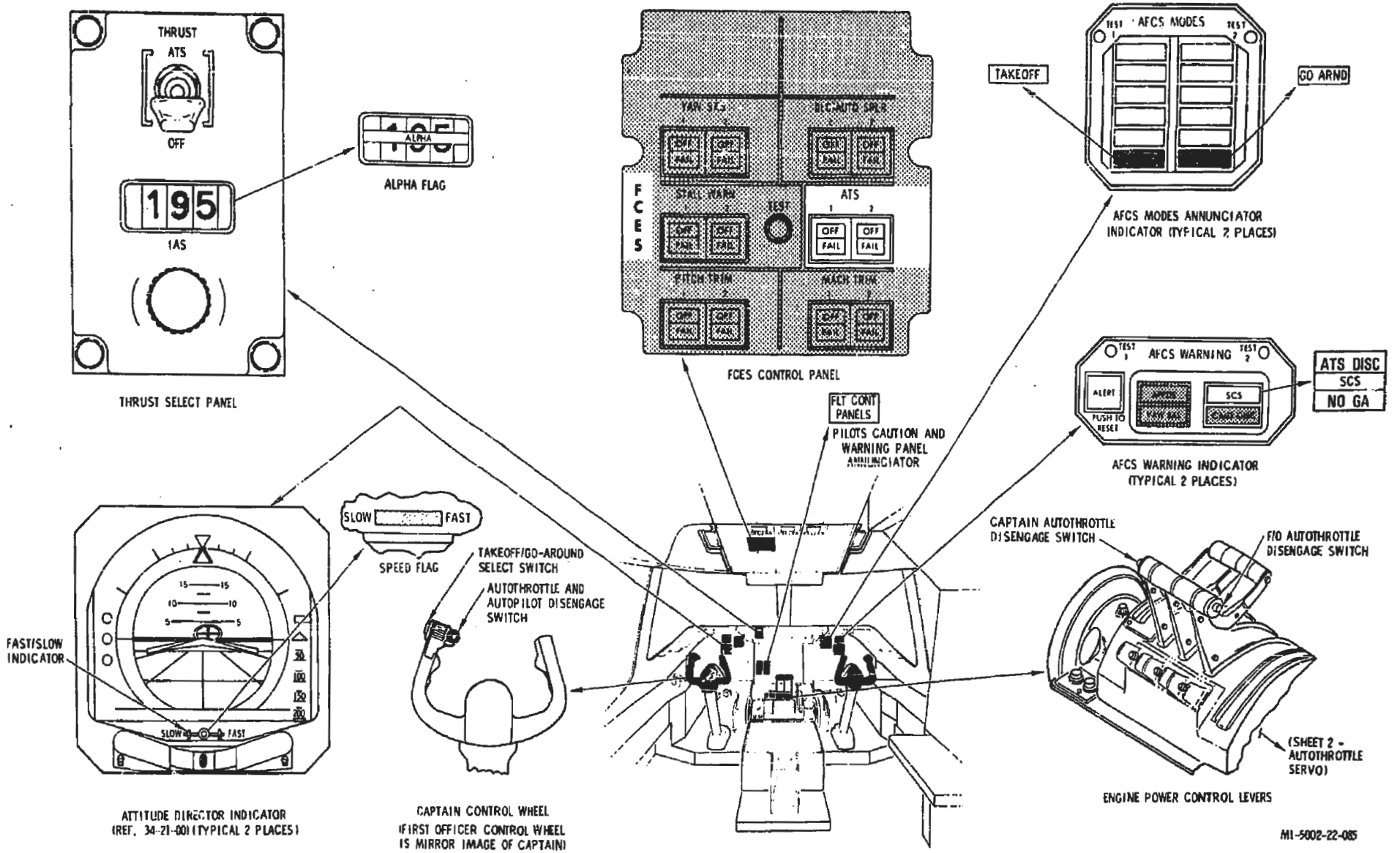
2. Operation

A. General

R Speed control system operation is broken down as power
R application, autothrottle mode, takeoff/go-around mode,
R fast/slow indication, and fault isolation monitoring for
R discussion.

R B. Power Application

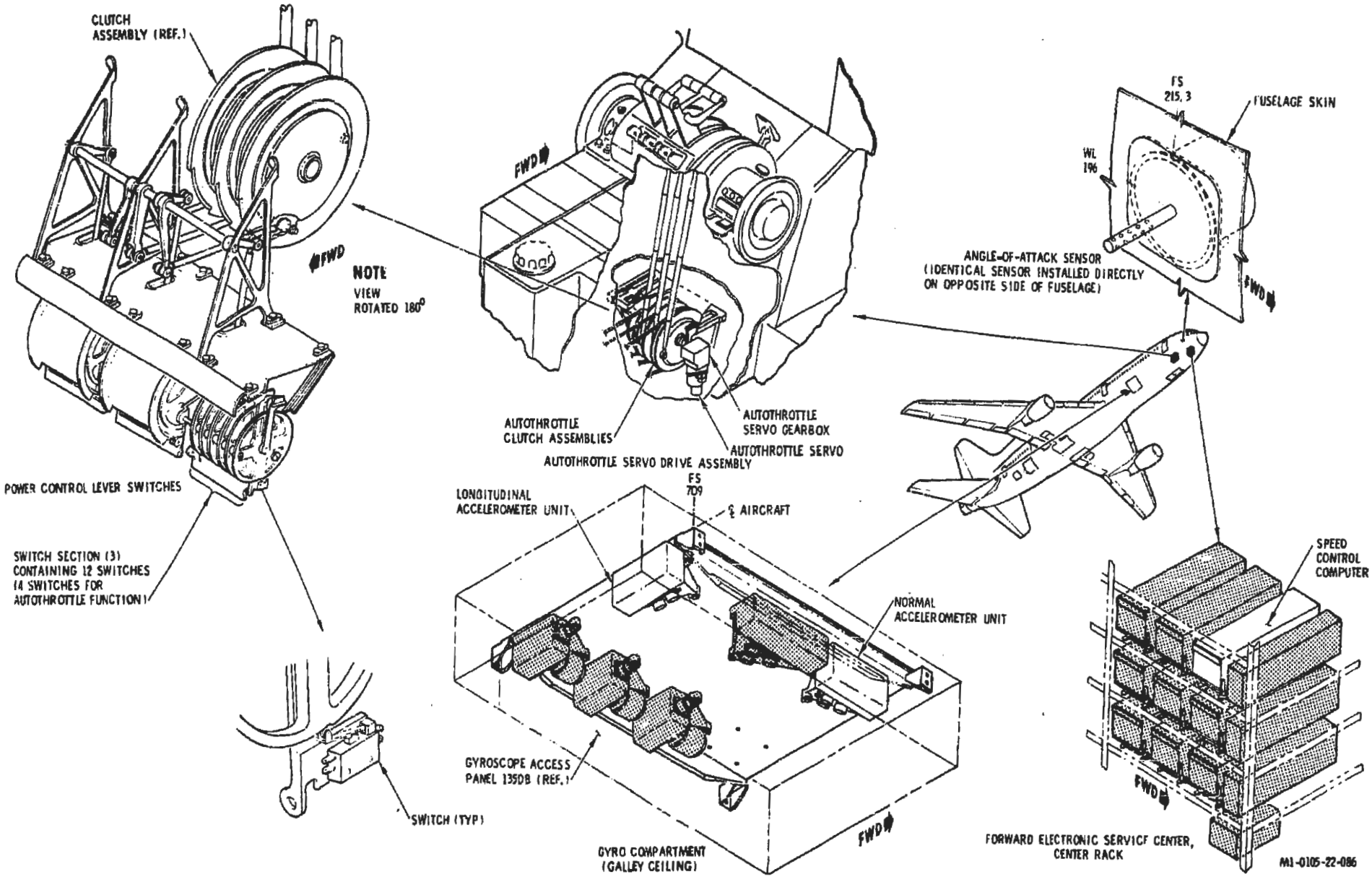
Primary power to the speed control system components is supplied by the ac essential, ac extension, and dc buses (Ref. Fig. 3). All circuit breakers applicable to the system are located on the pilots overhead circuit breaker



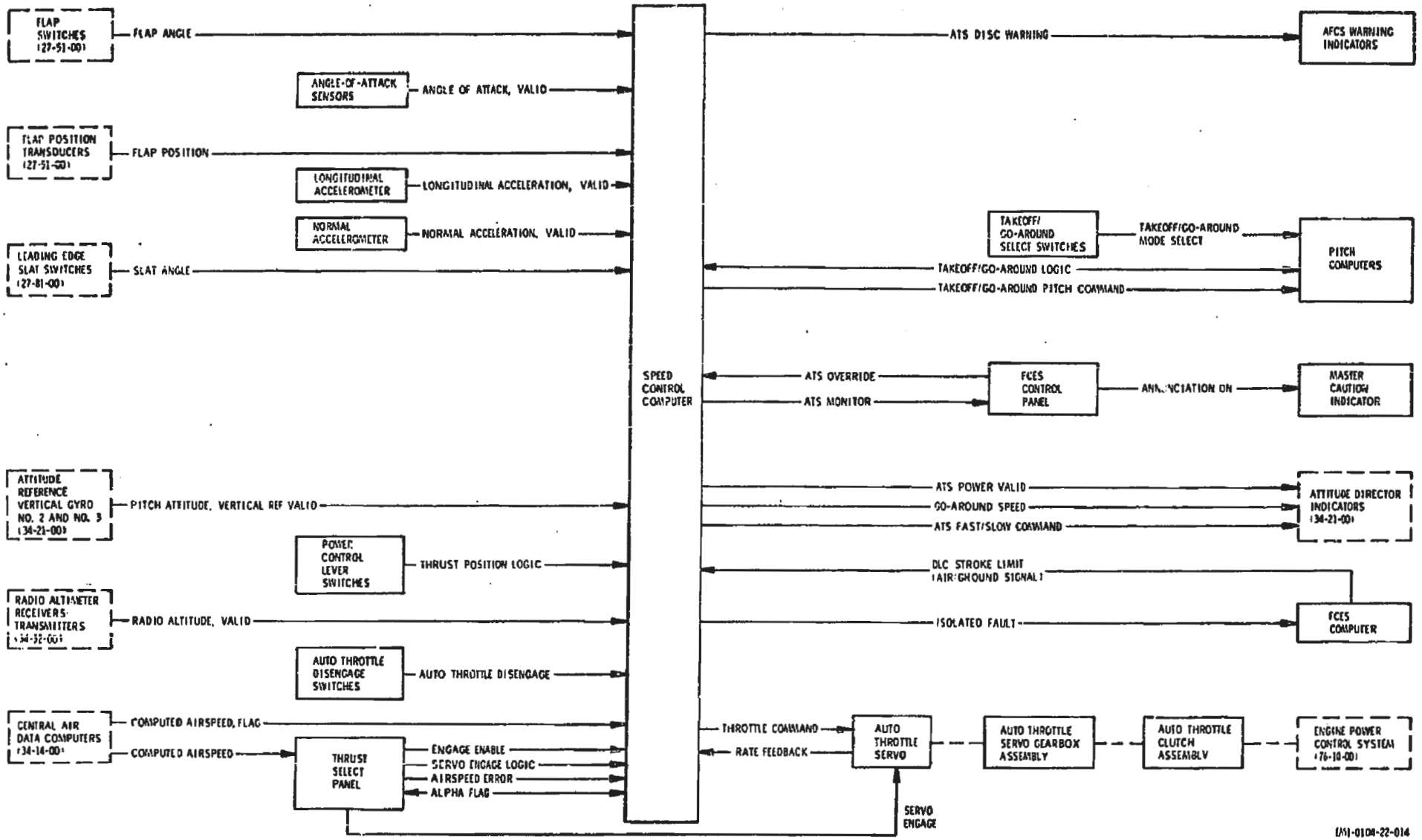
R Speed Control System Equipment and Location
R Figure 1 (Sheet 1)

EFFECTIVITY: ALL

001E



R Speed Control System Equipment and Location
R Figure 1 (Sheet 2)



R Speed Control System Interface Block Diagram
R Figure 2

EFFECTIVITY: ALL

001B

panel CB1, zone 210 and Flight Engineer/Second Officers overhead circuit breaker panel, CB2, zone 215.

The speed control computer channel 1 receives 115V, 400 Hz, phase A power from the essential bus through the AVIONICS FLIGHT CONTROL SYSTEM - AUTO THROT SERVO (A1) circuit breaker (on CB1). The computer channel 2 receives 115V, 400 Hz, phase B power from extension bus 2 through the AVIONICS FLIGHT CONTROL SYSTEM - NO. 2 SYSTEMS - SPEED CONT (A20) circuit breaker (on CB1). The ac voltage to each channel is processed by transformers and applied to the channel power supply where the required operating voltages are generated. The speed control computer receives 28V dc from the essential dc bus through the AVIONICS FLIGHT CONTROL SYSTEM - NO. 1 SYSTEMS - SPEED CONT (A2) circuit breaker (on CB1), and from dc buses 2 and 3 through the AFCS WARNING - CAPT (K18) and AFCS WARNING - F/O (K19) circuit breakers (on CB2). The dc voltages are used by the warning annunciator driver and fault isolation monitor circuits.

The AVIONICS FLIGHT CONTROL SYSTEM - AUTO THROT SERVO (A1) circuit breaker supplies power to the THRUST select panel through which the power is applied to the autothrottle servo as servomotor excitation voltage. The AFCS WARNING - CAPT (K18) and AFCS WARNING - F/O (K19) circuit breakers supply power to the AFCS WARNING indicators to arm the warning annunciator solenoids and alert switchlights.

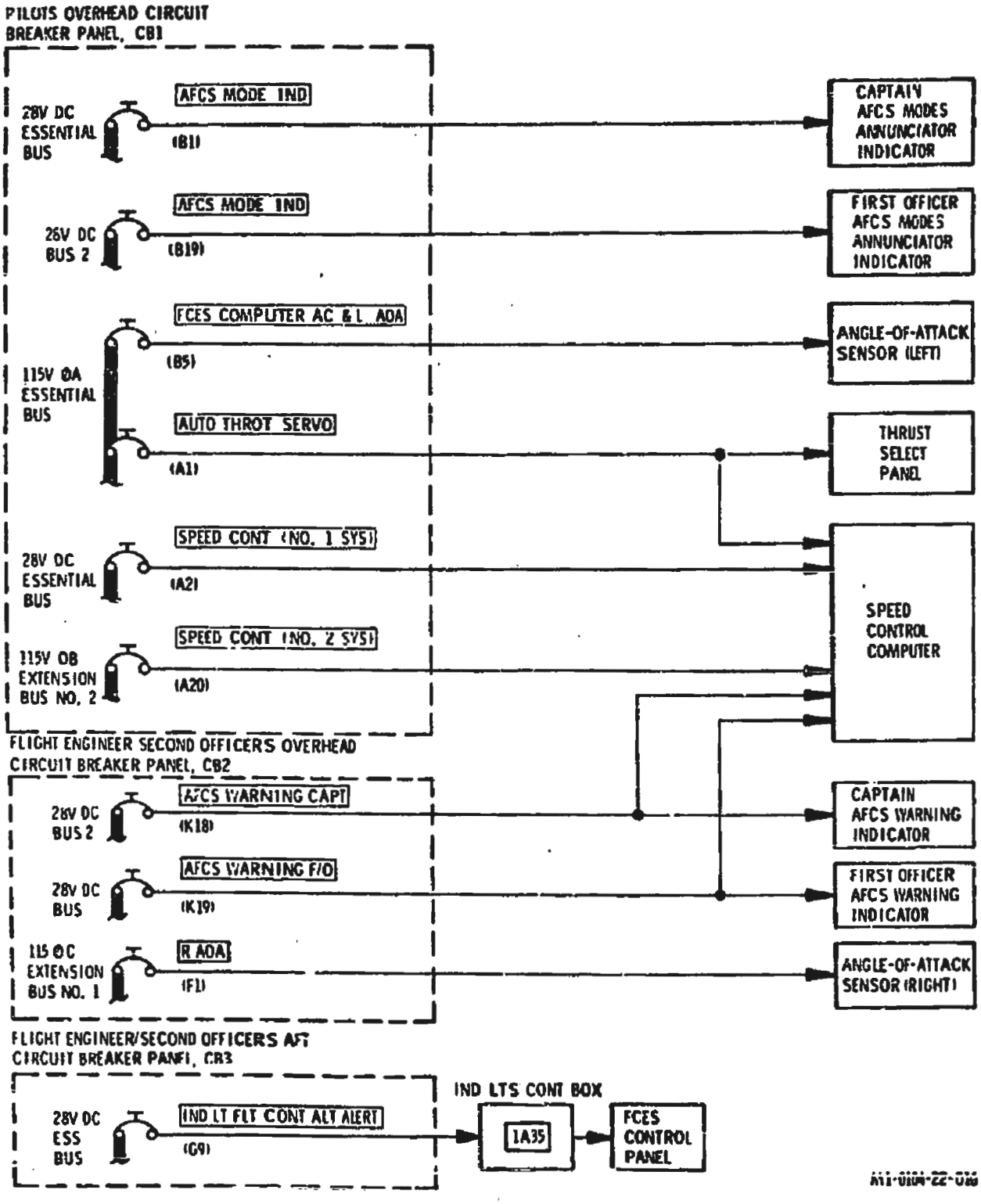
The left and right angle-of-attack sensors are excited by 115V, 400 Hz, phase A and B, from the AVIONICS FLIGHT CONTROL SYSTEM - FCES - COMPUTERS AC & L AOA (B5) circuit breakers (on CB1) and FLIGHT STATION MISC - R AOA (F1) circuit breaker (on CB2).

The AFCS MODES annunciator indicators receive 28V dc from the two AVIONICS FLIGHT CONTROL SYSTEM - AFCS MODE IND circuit breakers (on CB1) to arm the mode annunciator solenoids.

R C. Autothrottle Operation

(1) Autothrottle Engage

R Autothrottle is engaged by placing the solenoid-held engage switch on the THRUST select panel in the ATS position (Ref. Fig. 4). When the switch is in the ATS position, it applies the 28V dc from the speed control computer power supply to arm the switch holding solenoid. If the speed control system is not in the takeoff/go-around mode, the autothrottle channels are not overridden, all interlocks are satisfied, and the monitor outputs are valid, an engage enable signal



R R Speed Control System Primary Power Distribution Diagram
Figure 3

(ground) from the computer enables the switch-holding solenoid. When the switch is engaged, the THRUST select panel applies 115V ac (from the AVIONICS FLIGHT CONTROL SYSTEM - AUTO THROT SERVO (A1) circuit breaker) to the autothrottle servomotor. The THRUST select panel also provides an autopilot engaged logic signal to the speed control computer and the pitch computers to enable the autothrottle circuits.

(2) Monitor

Loss of a sensor validity signal or loss of computer monitor signals generates a logic switching signal. The switching logic signal is used to apply a pointer bias signal to the attitude director indicators to drive the fast/slow indicator pointer out of view.

Loss of power in the speed control system causes the power supply monitor to generate a speed flag bias signal. The bias signal is applied to the attitude director indicators to drive a flag in front of the fast/slow indicator.

(3) Mode Annunciation

The speed control system provides a mode annunciation on the THRUST select panel. When the speed control system switches to the stall margin mode, a flag signal is applied to the THRUST select panel driving the ALPHA FLAG in front of the airspeed select counter.

R NOTE: See Stall Margin Mode, Paragraph 2D(3), for Alpha Flag functional description.

(4) Failure Annunciation

Both ATS channels are comparison-monitored in the speed control computer. A fail-safe comparator detects any disagreement between the two channels. A channel may fail due to loss of validity in the sensors or associated equipment or due to a failure in the computation. The comparator applies a failure logic signal to the engage logic circuits of both channels. The circuits automatically disengage their respective channels. Upon disengagement, the following conditions occur:

(a) Fail signals are applied to the FCES control panel, which causes the FAIL message on the ATS 1 and 2 switchlights to come on.

(b) ATS fail signals are applied to the AFCS WARNING indicators to set the ATS DISC warning message and flash the ALERT switchlight.

(c) The engage enable signal to the THRUST select panel is removed, which causes the autothrottle engage switch to disengage.

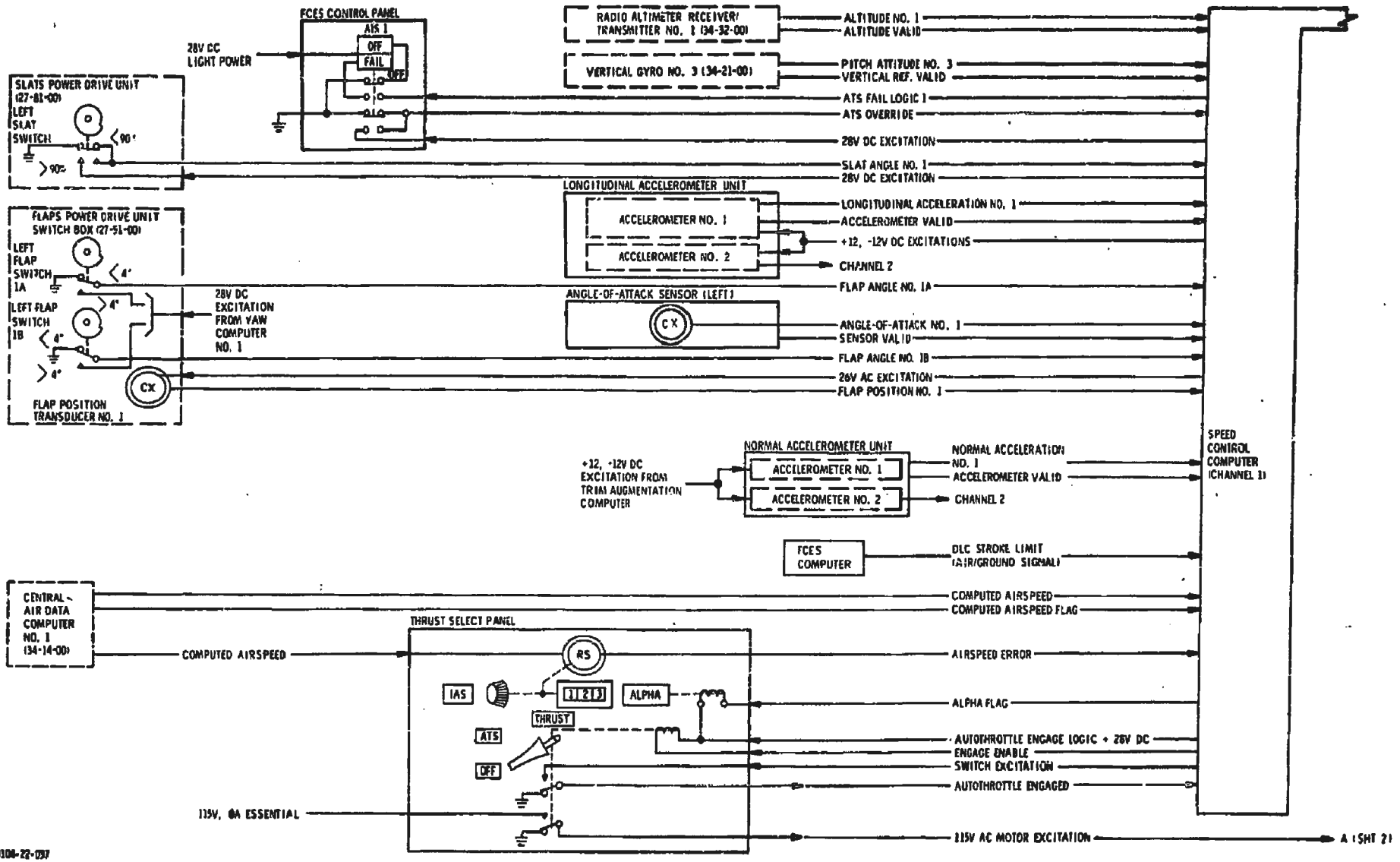
After the ATS disengages as a result of comparison monitoring, a single channel that has not failed may be reengaged. The warning on the AFCS WARNING indicators is reset by depressing either of the two autothrottle disengage switches or two successive depressions of the ALERT switchlight. The FAIL message on both ATS switchlights is acknowledged by depressing the switchlights; the FAIL message goes out and the OFF message on each switchlight comes on. The OFF message indicates that the associated channel is overridden. A single channel can now be reengaged by depressing an ATS switchlight. The reengaged channel will provide the engage enable signal to the THRUST select panel so the autothrottle engage switch can be reengaged. The single-channel engagement disables the cross-channel comparison monitoring capability.

(5) Autothrottle Limits

The autothrottle operating range is controlled by by forward mechanical stops and limit switches located at the minimum thrust limit positions. Actuation of the minimum thrust limit switches opens the control winding of the autothrottle servomotor to stop further throttle motion in that direction.

Three minimum thrust limit switches (Ref. Fig. 4) are provided. The minimum thrust limit switches are connected separately to the motor control enable logic circuit. Each switch output is normally a 28V dc signal. When any two switches are activated as a result of the throttle command driving the power controls to the minimum limit (excluding the condition after touchdown), the activated switches provide minimum thrust position signals (grounds) to the logic circuit. The signals cause the logic circuit to open the servomotor control winding. The switches remain activated until an increased throttle command signal is developed driving the power controls away from the minimum limit position.

(6) Autothrottle Disengagement



R Speed Control System Functional Block Diagram
R Figure 4 (Sheet 1)

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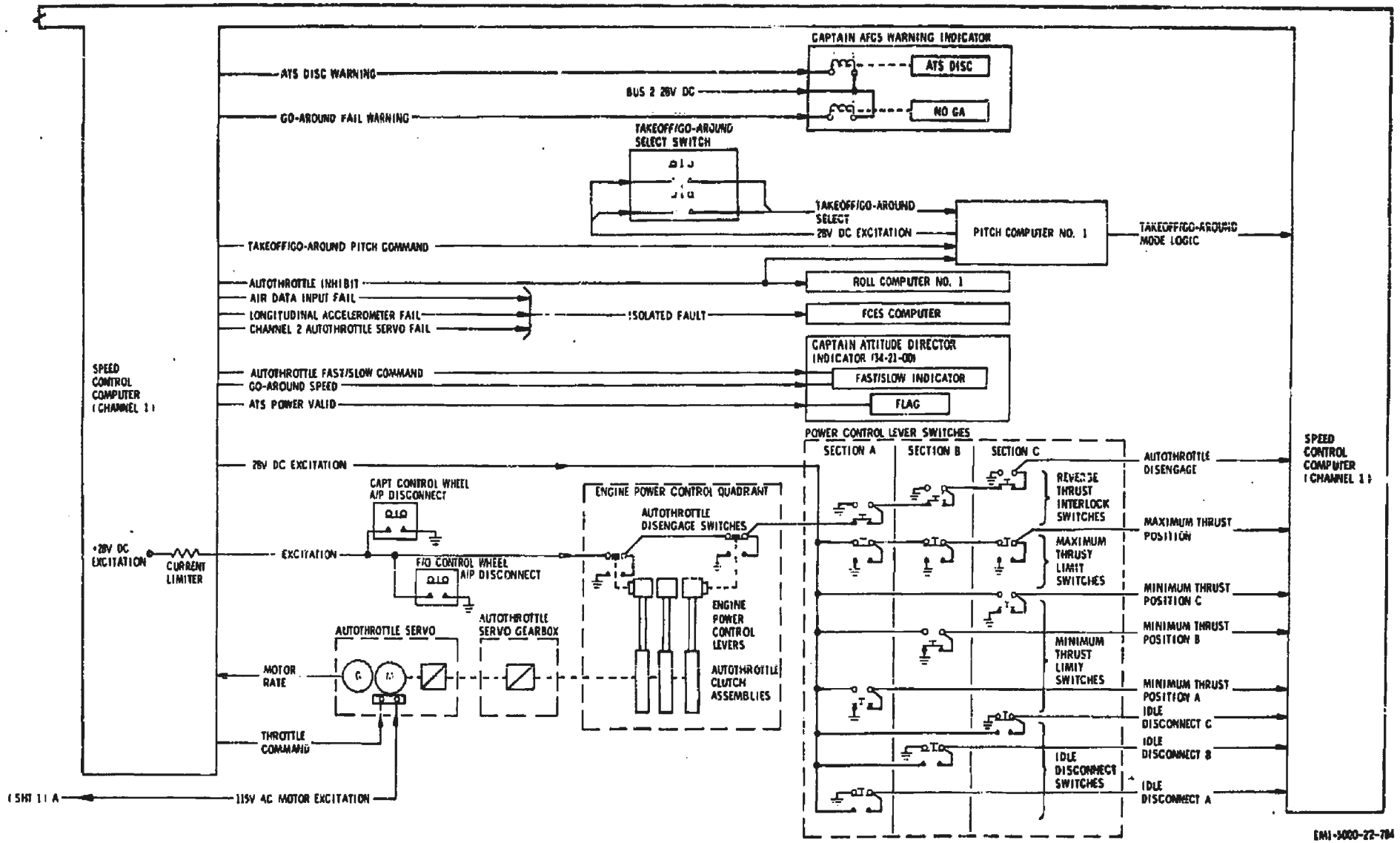

R Speed Control System Functional Block Diagram
R Figure 4 (Sheet 2)

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In addition to disengagement caused by a failure, the ATS disengages due to any of the following conditions:

Takeoff/go-around or turbulence mode is selected

IAS hold or MACH hold pitch mode is selected

Throttles retarded to idle after touchdown

Either of the two autothrottle disengage switches is depressed

Autothrottle engage switch on THRUST select panel is manually placed in OFF positions

When the takeoff/go-around mode, the turbulence mode, the IAS hold mode or the MACH hold mode is selected, the pitch computers provide logic signals to the speed control computer, which automatically disengages is selected the ATS. The autothrottle disengage switch breaks the engage circuit for quick-disconnect. When the autothrottle engage switch on the THRUST select panel is set to OFF position, the autothrottle servomotor excitation voltage and the servo engage logic signal to the speed control computer are removed.

The disengagement due to failure, autothrottle engage switch setting, IAS hold mode, MACH hold mode or turbulence mode selection results in a warning display on the AFCS WARNING indicator. The warning display is the ATS DISC message accompanied by the flashing ALERT indicator. The warning can be reset by depressing either of the two autothrottle disengage switches or depressing the ALERT indicator twice.

D. Autothrottle Operational Modes

(1) Autothrottle modes are airspeed, stall margin, flare, and touchdown. The speed control system automatically controls engine throttles when the autothrottle is engaged and operating in one of the above modes. The fast-slow indicators on the ADI provide manual throttle control information when the autothrottle is not engaged.

(2) Airspeed Select Mode

The airspeed mode of autothrottle controls the throttles to maintain the airspeed selected on the THRUST select panel. A new airspeed reference can be established with the mode in operation by selecting a desired airspeed on the panel. The airspeed select

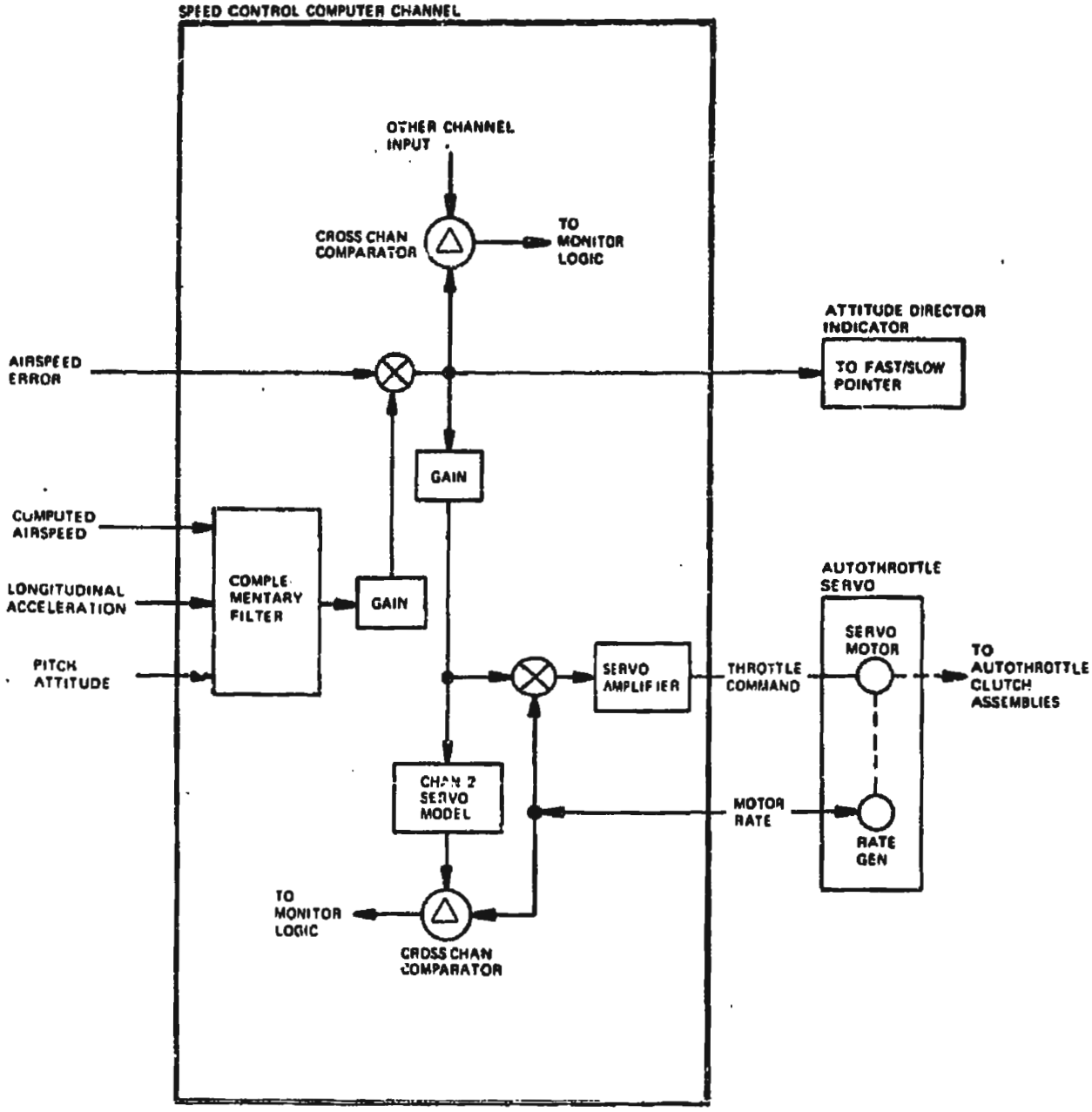
mode is operable over the entire altitude and speed envelope of the aircraft with a maximum error of ±5 knots, or ±2 percent of the selected airspeed (maintains selected airspeed within ±3 knots below 10,000 feet and 250 knots). The airspeed select mode is automatically switched to the stall margin mode if the airspeed falls below the computed stall margin speed.

The speed control computer channels (Ref. Fig. 4) receive a flap position signal from the flap position transducers in the flaps power drive unit (Ref. 27-51-00) and computed airspeed from the central air data computers (CADC) (Ref. 34-14-00). If the flap angle is less than 30 degrees and the computed airspeed is above the stall margin speed (1.3 stall speed), the computer logic switching allows the airspeed select mode computation to be processed.

The airspeed computation (Ref. Fig. 5) is based on inputs from the THRUST select panel, the longitudinal accelerometer, the vertical gyro (Ref. 34-21-00), and the CADC. The THRUST select panel receives the computed airspeed from the CADC and compares it with the manually selected airspeed. The resultant error signal is applied to the computer. The longitudinal acceleration signal from the accelerometer is modified by the pitch attitude signal from the vertical gyro and the computed airspeed from the CADC. The selected airspeed error and complemented longitudinal acceleration are used to compute the autothrottle command rate.

The channel one command rate output is normally connected to the autothrottle servo and channel two is used for comparison. If the outputs of the two channels do not agree, the computation comparator provides a logic output signal to disengage the autothrottle servo. When disengagement occurs, a failure annunciation is enabled and a functional channel can be reengaged.

The computed command rate is applied to the servo loop and to a servo model. The servo loop output is applied to the autothrottle servomotor as a throttle command signal. A rate generator senses and feeds back the motor rate to the servo loop input. The feedback dampens the servomotor and prevents overshooting. The servomotor shaft is coupled to the servo gearbox. The gearbox reduces the servomotor output to a speed compatible to drive the throttles. The gearbox output torque drives the three clutch assemblies



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Airspeed Select Mode
Figure 5

simultaneously. Movement of the individual clutches adjusts the respective engine throttles through advance or retard control cables. The clutches also position the engine power control levers proportional to the throttle command.

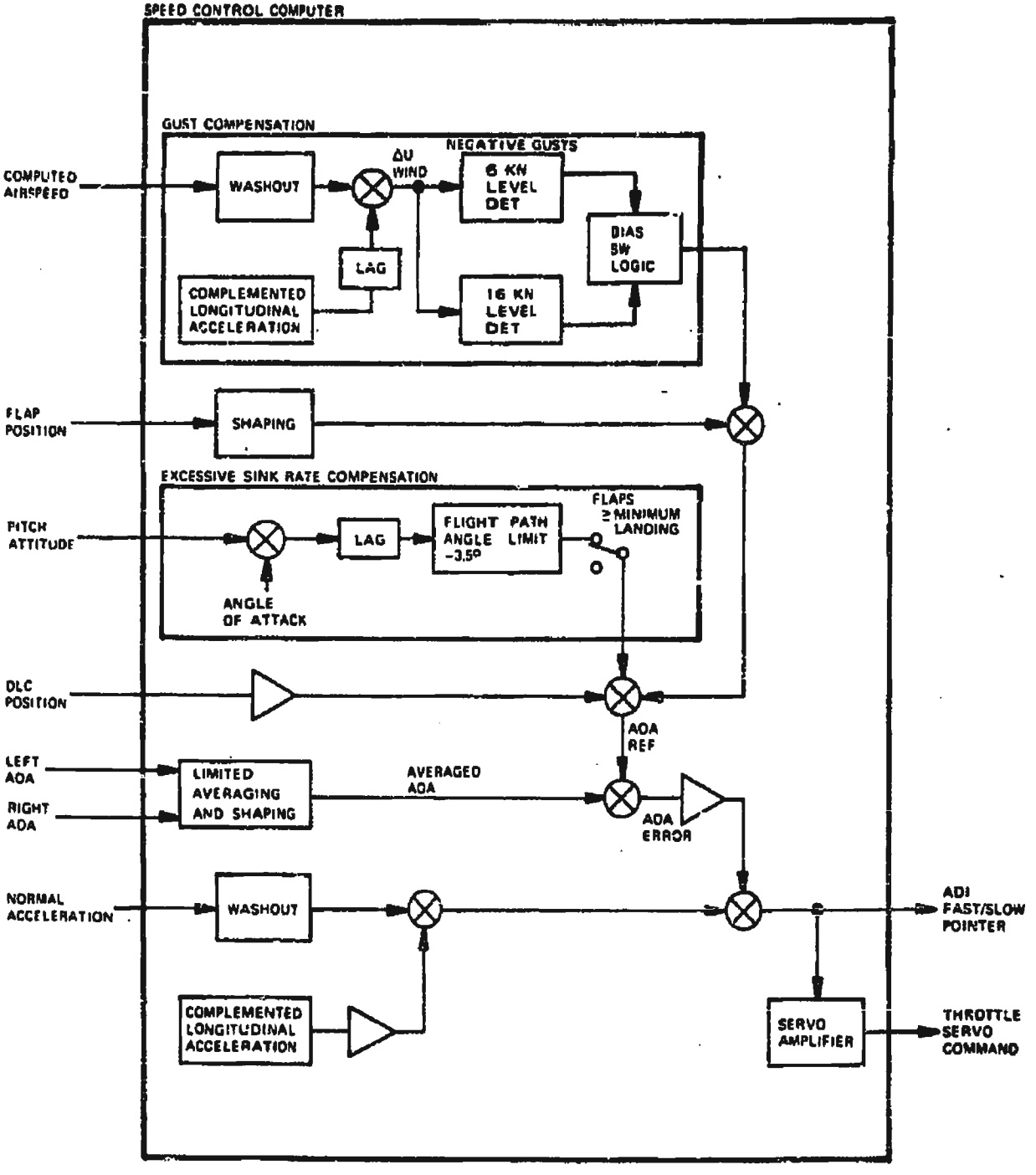
The servo model output is compared to the rate feedback. If the servo model output and the rate feedback do not agree, the servo monitor comparator provides a logic signal to disengage the autothrottle servo.

(3) Stall Margin Mode

In the stall margin mode, autothrottle controls the engine throttles to maintain an angle-of-attack equivalent to the computed stall margin speed (1.3 stall speed). The autothrottle computation is switched to the stall margin mode from the airspeed mode if the flaps are extended beyond 30 degrees or if the airspeed decreases to or less than the stall margin speed. This switching enables the computer to provide an alpha (angle-of-attack) flag signal to the THRUST select panel (Ref. Fig. 4). The signal causes the ALPHA flag to obscure the selected airspeed indication.

The Alpha flag function is active anytime power is applied to either or both ATS. Thus, Alpha flag may be displayed while aircraft is on ground and Stall margin condition is sensed by either or both AOA sensors assuming high angle-of-attack. On ground, AOA sensors may assume extreme angle-of-attack due to combinations of irregular airflow, stall warning system self test, AOA sensor biases, or system tolerances. The stall margin mode (Ref. Fig. 6) computation is based on inputs from the alpha sensors, the normal accelerometer, the flap power drive unit switch box, and the computer. The stall margin mode also requires the complemented longitudinal acceleration derived as in the airspeed select mode.

The left and right alpha sensors provide aircraft alpha signals to the speed control computer. These signals are averaged to cancel the effects of roll rate and sideslip angle. The averaged alpha signal is compared with an alpha reference equivalent to an airspeed of 1.3 stall speed. The alpha reference is derived from the flap position signal from the flap position transducer and is modified by the direct lift control servo position signal from the FCES computer.



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R Stall Margin Mode
R Figure 6

The derived alpha error, the complemented longitudinal acceleration, and the vertical acceleration obtained from the normal accelerometer are fed to the computation. The result of the computation is the autothrottle command rate. The command rate is processed for throttle control in the same manner as the airspeed select mode.

Automatic gust compensation is provided in the stall margin mode. The gust compensation circuit adds an increment of speed to the alpha reference as a function of the gust level encountered. The gust level is computed as a function of computed airspeed and complemented longitudinal acceleration, the resultant of which is passed through the level detectors. The detectors determine if the gust level is above 6 knots or above 16 knots, and cause a bias signal to be summed to the alpha reference derivation. For the 6 to 16 knot gust level, the bias decreases the alpha reference by 0.9 degree (0.05 stall speed). For gust levels above 16 knots, the reference is decreased 1.8 degrees (0.10 stall speed). The bias is switched into the stall margin computation upon sensing gusts and remains for 20 seconds after the gust is sensed.

The stall margin mode also provides excessive sink rate compensation. The sink rate compensation circuit adds an increment of speed to the alpha reference as a function of pitch attitude and angle-of-attack if the flight path angle is greater than -3.5 degrees and the flaps are greater than 30 degrees.

(4) Flare Mode

During the landing phase, autothrottle retards the throttles at the computed flare rate. When the aircraft descends to the flare altitude (approximately 56 feet), the altitude signal from the radio altimeter (Ref. 34-32-00) is applied to the flare logic circuit. The circuit switches a flare bias signal (Ref. Fig. 7) which is summed with complemented longitudinal acceleration. The resultant command rate is applied to the servo loop. The flare bias causes the throttles to retard at a rate of 1.0 knots per second.

(5) Touchdown Mode

At touchdown, autothrottle retards the throttles to the idle position at a faster rate than in the flare mode. When the FCES computer senses truck tilt or weight-on-wheels (touchdown), the computer provides a touchdown bias signal (Ref. Fig. 7) to the servo loop.

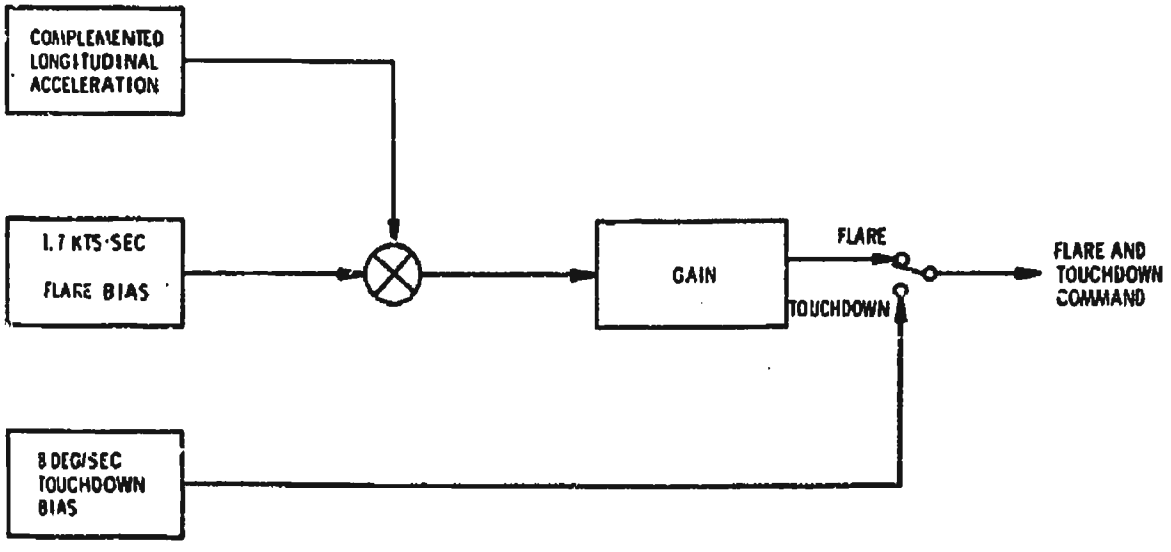
The bias signal provides an 8 degree-per-second retard rate used to drive the throttles to the idle position.

When the throttle idle positions are achieved, autothrottle is automatically disengaged. The disengagement is caused by the idle disconnect signals from the idle disconnect switches (in the engine power control position switch sections) to the computer engage logic circuit. This signal inhibits the command output signal from the computer. At the same time, the engage enable signal is removed from the autothrottle engage solenoid in the THRUST select panel. The loss of signal to the solenoid causes the engage switch to drop to the OFF position which removes the autothrottle servomotor excitation without the ATS DISC message being displayed on the AFCS WARNING indicator.

E. Takeoff/Go-around Operation

(1) Takeoff/Go-around Engage

The takeoff/go-around mode is engaged by depressing the takeoff/go-around select switch on either the Captains or First Officers control wheel (Ref. Fig. 4). When the switch is depressed, the pitch computer generates a takeoff or go-around logic signal which is applied to



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R
R Flare and Touchdown Modes
Figure 7

the speed control computer switching circuits. The switching circuits disable the autothrottle function and activate the takeoff/go-around computation.

(2) Monitor

In the takeoff/go-around mode, the pitch computer requires the takeoff/go-around validity logic signals from the speed control computer comparator and power supply monitors.

(3) Mode Annunciation

R R The TAKEOFF message is in view (on aircraft without SB34-178),on the AFCS MODES indicator when the TO/GA switch on the control wheel is depressed while on the ground and a flight director is engaged. The flight director will display takeoff and climbout commands.

R R The GO ARND (on aircraft without SB34-178), TO/GA (on aircraft with SB34-178) message is in view on the AFCS MODES indicator when the TO/GA switch is depressed while in the air if an autopilot or flight director is engaged. Autothrottle is disconnected, and wings level and optimum pitch attitude achieved.

(4) Failure Annunciation

The go-around failure logic signal is provided when the go-around computation comparison monitor senses computational discrepancies. The monitor then applies a failure logic signal to the AFCS WARNING indicators enabling the NO GA annunciation and the flashing ALERT switchlight. The NO GA annunciation is enabled only after glideslope capture and if the go-around mode or ATS DISC have not been selected. The warning annunciations are cancelled by depressing the ALERT switchlight twice, or by selecting another flight mode.

F. Takeoff/Go-Around Operational Modes

(1) General

The speed control computer provides computations to the autopilot flight director system (APFDS), which controls the pitch command bar on the ADI during takeoff and go-around maneuvers. The go-around mode can be used as either an autopilot or flight director mode, whereas the takeoff mode is a flight director mode only. The takeoff and go-around modes operate only in dual-channel fail-passive configuration. The computation for takeoff and go-around modes are

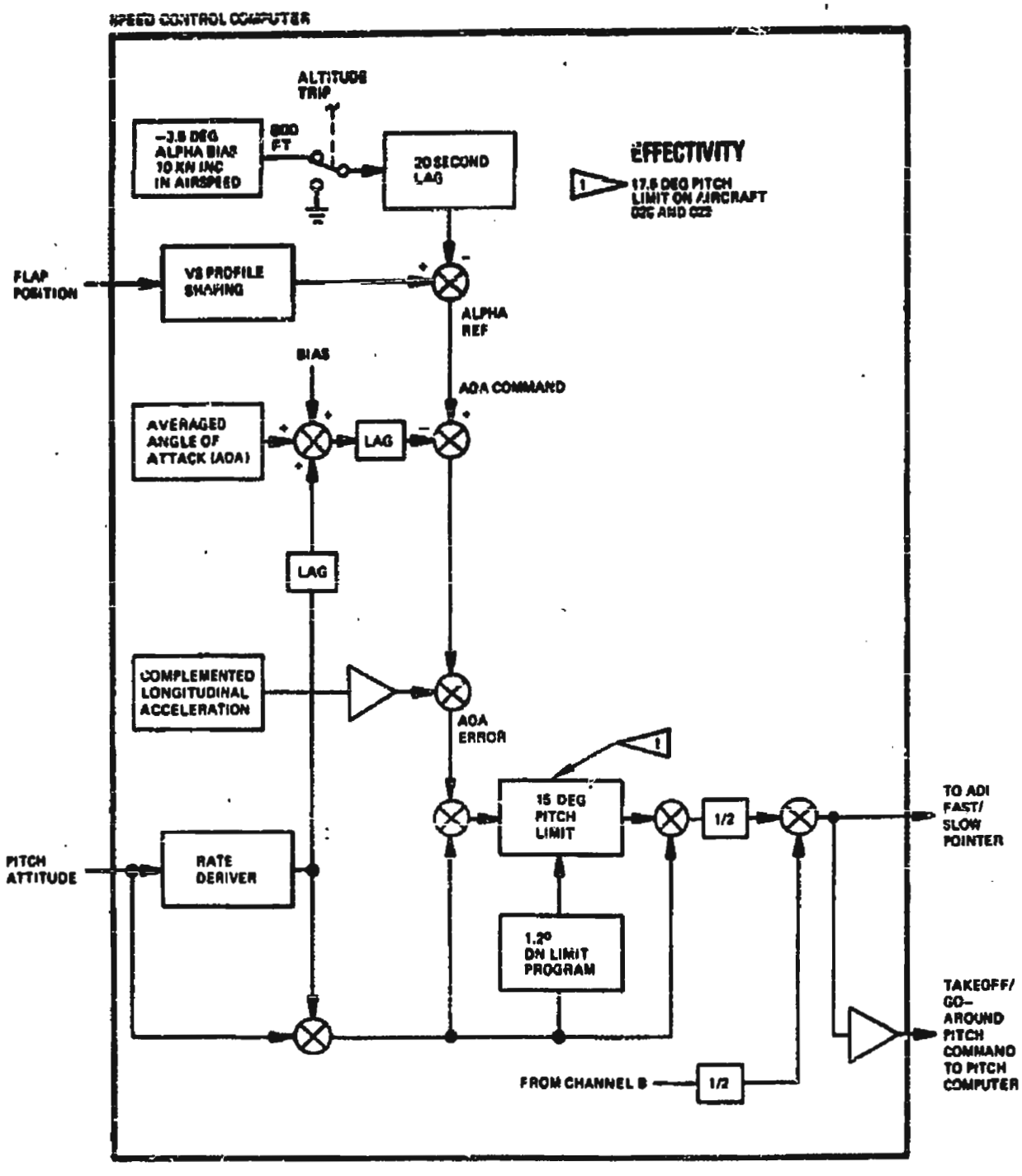
identical. The following discusses the go-around and takeoff modes.

(2) Go-around Mode

The go-around mode is available for autopilot and flight director control. When an approach has failed to meet the landing requirements, the mode selection is made by depressing the takeoff/go-around switch (Ref. Fig. 4) located on the control wheel. The mode provides the capability for an optimum go-around maneuver. The go-around mode results in go-around pitch command computations by the speed control computer for the autopilot flight director system (APFDS). Pitch command is provided to rapidly arrest the descent rate and provide a programed climbout profile.

Upon go-around engagement (takeoff/go-around switch depression), the APFDS pitch computer generates a go-around logic signal which is applied to the speed control computer switching circuits. The switching circuits disable the autothrottle function and activate the go-around function. Go-around engagement is
R indicated by the GO ARND (on aircraft without
R SB34-178), TO/GA (on aircraft with SB34-178) annunciation on the AFCS MODES annunciator indicators. If go-around is engaged during the dual AUTOLAND mode, the autopilot channel engaged last is automatically disengaged. If go-around is engaged during a single channel approach of the AUTOLAND mode, the operating autopilot channel remains engaged. All pitch axis guidance computations are overridden until the go-around mode is disengaged by selecting one of the pitch axis control modes.

Go-around pitch command (Ref. Fig. 8) is computed by the speed control computer as a function of the local angle-of-attack (alpha), longitudinal acceleration, flap position, and pitch attitude inputs. The alpha signals from the left and right alpha sensors are averaged to cancel the effects of roll rate and sideslip angle. The existing flap position signal is used to derive an alpha reference equivalent to an airspeed of 1.25 stall speed. The averaged alpha, alpha reference, longitudinal acceleration (modified by pitch attitude), and pitch attitude signals are fed to the computation channel. The computed result of each channel is the go-around pitch command signal. The computation minimizes pitch overshoot and limits the go-around angle to a maximum of 15 degrees on aircraft 001-027, 030-999 and 17.5 degrees on aircraft 028, 029.



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Takeoff and Go-Around Modes
Figure 8

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Upon reaching an altitude of 800 feet in the go-around profile, the reference to which the aircraft is controlled is increased to 1.25 stall speed plus 17 knots at a rate of 1 knot per second by reducing the alpha reference by 3.5 degrees.

The go-around pitch command signals are applied to the APFDS pitch computers which in turn process the pitch command output signals for application to the stabilizer autopilot servo. If the autopilot is engaged in the basic (CWS) mode, or if the flight director is engaged for manual control, the pitch command signals are sent to the attitude director indicators (ADI) for steering command displays. The ADI also receives the pitch command signal for display on the fast-slow indicator to monitor the go-around maneuver.

The go-around mode is disengaged by selecting one of the pitch axis control modes (altitude hold, mach hold, vertical speed and indicated airspeed hold). The speed control computer then reverts to the throttle command computations.

(3) Takeoff Mode

The takeoff mode is a flight director mode only. The mode is initiated by depressing the takeoff/go-around switch (Ref. Fig. 4) on the control wheel. With the aircraft on the ground and the takeoff mode initiated, the takeoff mode automatically engages as a function of the main landing gear strut switch, flight director engagement, and other interlocks. The mode is
R indicated by the TAKEOFF (On aircraft without
R SB34-178), annunciation on the AFCS MODES annunciator indicators. The takeoff mode results in takeoff pitch command computations performed by the speed control computer for the APFDS. The computations (Ref. Fig. 8) are the same as for the go-around mode. The computed pitch command signals are processed through the pitch computers whose outputs are applied to the attitude director indicators for steering command displays. The command presented on the ADI command bars should only be followed after rotation as the angle-of-attack sensors reflect any turbulence due to the aircraft proximity to the runway. The ADI command bar slowly moves up as the aircraft rotates. The computation minimizes pitch overshoots and limits the takeoff angle to a maximum of 15 degrees on aircraft 001-027, 030-999 and 17.5 degrees on aircraft 028, 029.

The reference to which the aircraft is initially controlled is an alpha equivalent to 1.25 stall speed with a maximum limit of 15 degrees on aircraft 001-027, 030-999 and 17.5 degrees on aircraft 028, 029. Upon reaching an altitude of 800 feet in the takeoff climb profile, the reference is increased to 1.25 stall speed
R plus 17 knots.

The takeoff mode is disengaged by selecting one of the pitch axis control modes (altitude hold, mach hold, vertical speed, and indicated airspeed hold). The speed control computer then reverts to the throttle command computations.

G. Fast/Slow Indicator

A fast/slow indicator is provided on the attitude director indicators (Ref. 34-21-00). The fast/slow indicator monitors the performance of autothrottle, and deflects in response to the fast or slow signal from the speed control computer. The pointer is centered when the autothrottle command and the aircraft speed are equal. The signal is continuous regardless of the autothrottle mode. When the autothrottle computation is in the airspeed mode, the signal is proportional to the selected airspeed error. In the stall margin mode, the signal is proportional to the angle of attack error. In the flare mode, the signal is proportional to the flare throttle command. In the takeoff/go-around mode, the signal is proportional to the takeoff/go-around pitch command. When the fast/slow signal is invalid, the indicator pointer is driven out of view.

A flag is provided to obscure the fast/slow indicator when power loss occurs in the speed control system. Normally, the flag is held out of view by 28V dc from the speed control computer. The flag is independent of the fast/slow indicating function.

H. Fault Isolation Monitoring

The speed control computer is provided with a fault isolation monitor (FIM). When a failure occurs in the autothrottle the monitor isolates the area of failure and provides a fault indication for ground maintenance purposes. If the fault is in the computer, the monitor sets the FIM annunciator on the computer front panel. The monitor can also isolate a fault to the air data inputs, the longitudinal accelerometer, and the autothrottle servo. A fault in these areas causes the monitor to set the associated FIM annunciator on the FCES computer (Ref. 22-17-00) front panel. The annunciators are designated AIR

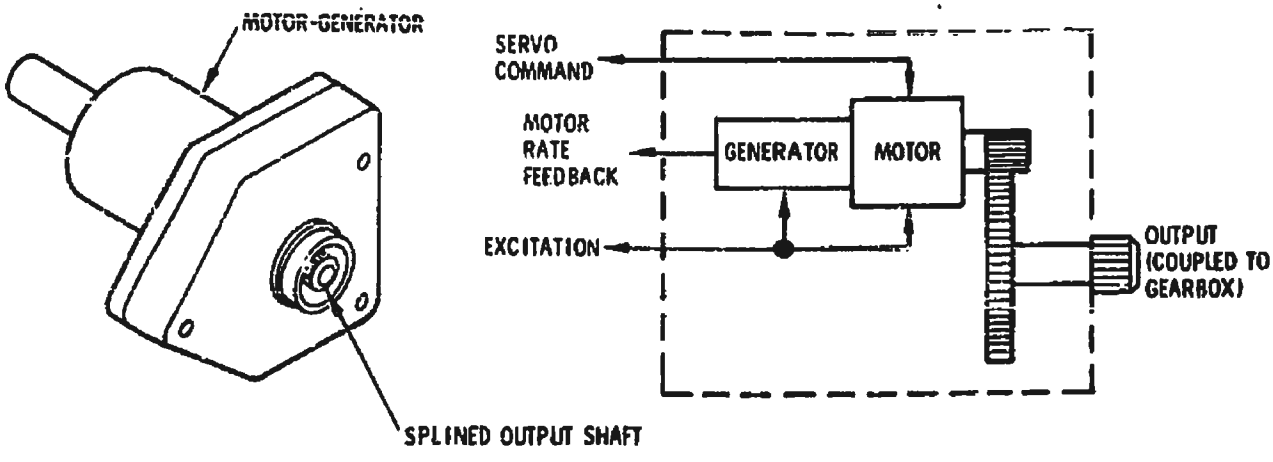
DATA INPUTS, LONG. ACCEL., and AUTO THT SERVO. See 22-09-00 for an operational description of the FIM annunciators.

3. Autothrottle Servo

A. Description and Operation

The autothrottle servo (Ref. Fig. 9) converts an electrical servo command signal into a proportional mechanical force. The servo unit contains a common shaft motor-generator and a reduction gear train. An electrical receptacle is provided for system interface. A splined output shaft projecting from the opposite end is coupled to a gearbox. Mounting provisions are made to secure the unit to the gearbox.

Servo command signals from the autothrottle computer are applied to the servomotor, which induce an output on a gear on the motor drive shaft. The output is transferred through the 10 to 1 reduction gear train to the splined output shaft. A rate generator, which is mounted on the servomotor drive shaft, produces a voltage proportional to the speed of the servomotor. This voltage is applied as a motor rate feedback signal to complete the autothrottle command servo loop.



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Autothrottle Servo
Figure 9

4. Autothrottle Clutch Assembly

A. Description and Operation

The autothrottle clutch assembly consists of a reverse-locking clutch, torque limiter, and cable sheaves. A splined hole is provided in the center of the clutch assembly for coupling to the splined servo drive shaft of an input unit. A mounting hole is provided to attach the engine power manual control lever (thrust lever).

There are three clutch assemblies commonly coupled to the servo drive shaft. The drive shaft is coupled to a servo gearbox which is driven by a servomotor. The individual clutch assemblies are connected to their respective engine throttles by the power-advance and power-retard control cables. The individual clutch assemblies are also coupled to their respective engine power manual control levers.

The clutch assembly permits automatic servo-operated throttle control, with provision for manual control lever override or adjustment by the pilot. When the autothrottle system is driving the clutch assemblies, the manual control levers move as if being positioned manually. The manual control levers move in unison since the clutch assemblies are driven by a common servo drive shaft. In manual operation, the control levers can be positioned individually and one lever movement has no effect on the remaining levers.

The clutch assembly consists of three concentric members designated as input, output, and control. The input member accepts the servo drive shaft input and turns in response to autothrottle servo command signals. The output and control members are rotatable independent of the input member. The output member is linked to the engine throttle through a sheave and cables. The control member is connected to the engine power control lever. During autothrottle operation, the servo torque drives the input member. The input member drives the output and control members in the same direction through a sprag action. During manual control operation, the control lever drives the control member which in turn drives the output member in the same direction. The input member is uncoupled by the sprag action.

The clutch assembly torque limiter relieves the drag on the clutch output member if the applied force becomes excessive. Since the clutch assembly is driven by an irreversible servo drive, drag is created when the downstream force exceeds two or three times the normal operating level of the clutch assembly. The torque limiter is set to slip the clutch to

reduce excessive tension on the cabling, the linkages, and the clutch assembly.

5. THRUST Select Panel

A. Description and Operation

The THRUST select panel (Ref. Fig. 10) provides autothrottle engagement and selection of indicated airspeed for autothrottle operation. The panel consists of an autothrottle engage switch, an indicated airspeed selector knob and indicator, solenoids, and differential resolvers. The front panel is internally edge-lighted. An electrical receptacle is provided on the rear of the panel.

The autothrottle engage switch is a wafer type, magnetically operated switch (Ref. Fig. 11). When the engage switch knob is placed from the OFF to the ATS position, the knob remains in the ATS position only when all autothrottle engage logic requirements are met. With the engage logic established, the switch is held in the ATS position by a solenoid energized by an engage enable signal from the speed control computer. The engage switch provides power to an autothrottle servo and an autothrottle servo engaged logic signal to the speed control computer.

The indicated airspeed (IAS) selector knob is mechanically linked to the IAS numerical indicator (counter) and two differential resolvers. The selector knob is capable of selecting an airspeed within the range of 100 to 450 knots. The knob is rotated until the desired airspeed is shown on the IAS indicator. Concurrently, the two differential resolvers are positioned relative to the selected airspeed. The two differential resolvers correspond to the two channels of the autothrottle system. Each differential resolver receives a computed airspeed signal and compares this signal with the selected airspeed. The result of comparison is the airspeed error. The airspeed error signal is sent to the system computer for computation of throttle position required to achieve the selected airspeed.

The IAS indicator contains an ALPHA flag which remains out of view when autothrottle is in the airspeed mode. The flag appears in front of the IAS indicator counter when autothrottle switches from airspeed control to the angle-of-attack (alpha) control during the approach mode. The flag is driven into view by a solenoid energized by an alpha flag signal.

AUTOTHROTTLE SYSTEM (ATS) SWITCH

Two-position toggle switch.

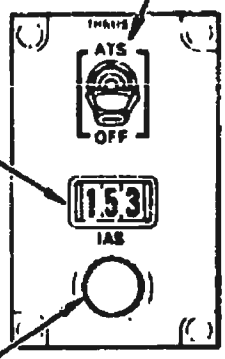
ATS - Engages autothrottle to hold selected speed above $1.3V_s$. Single or dual channel engagement is provided by switch selection on FCES panel. When flaps move through 30 degree down position or IAS drops below $1.3V_s$, ALPHA (angle of attack) flag covers IAS readout. Gust and CG compensation is provided in the ALPHA mode.

Automatically disengages with Go-Around switch or TURB engagement or on landing.

OFF - Disengages ATS.

IAS DISPLAY

Indicates selected airspeed. ALPHA flag (not shown) obscures IAS numbers when system is operating in ALPHA mode.



IAS SELECTOR KNOB

Rotary knob that provides selection of the IAS reference for the speed command system. A minimum of 1.3 V_s is automatically programmed in the IAS mode regardless of speed selected.

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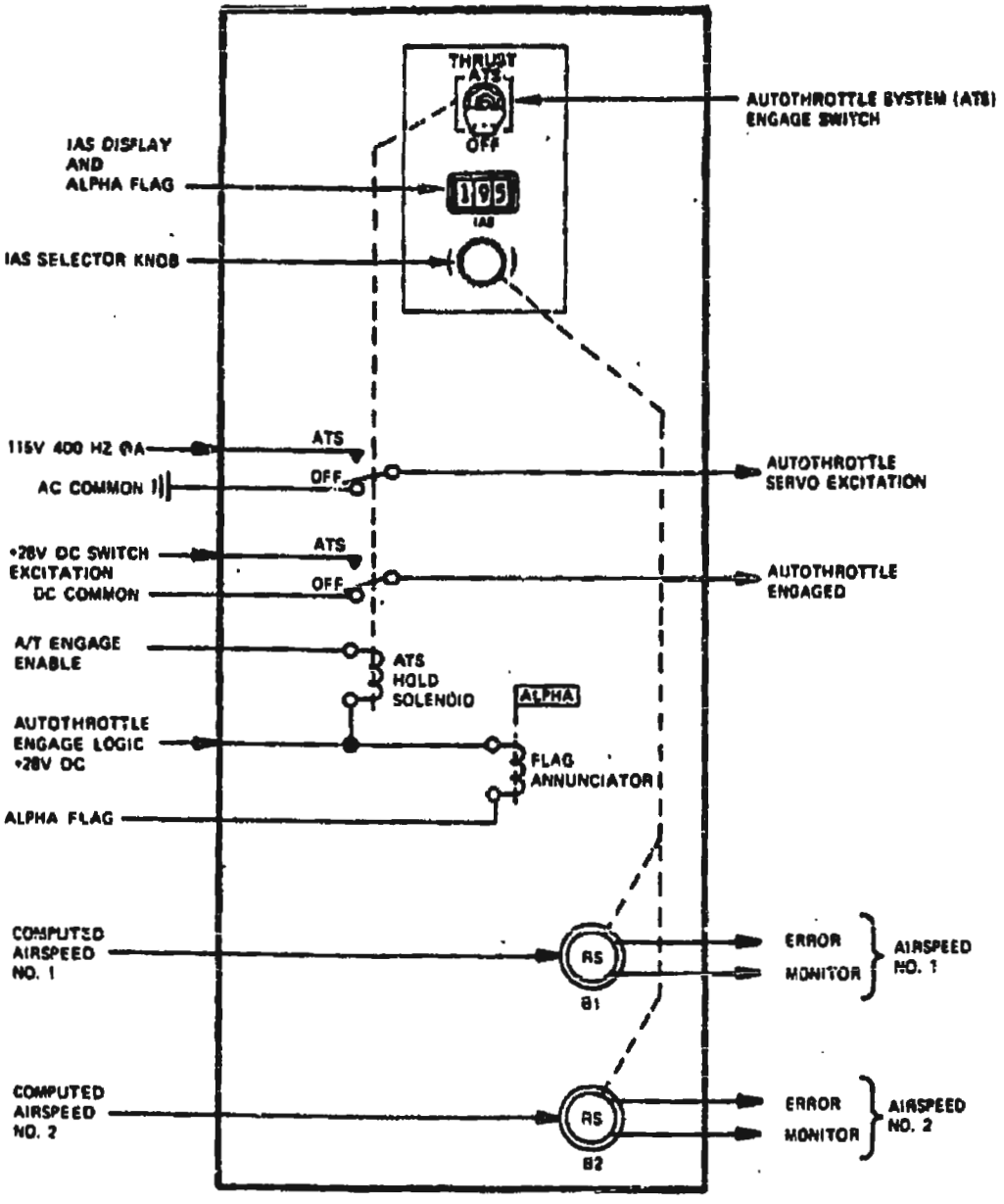
Thrust Select Panel
Figure 10

EFFECTIVITY: ALL

001B



EM1-0102-22-026

R Thrust Select Panel Simplified Schematic Diagram
R Figure 11

6. Autothrottle Servo Gearbox

A. Description and Operation

The autothrottle servo gearbox reduces the autothrottle servomotor output speed to a speed compatible to drive the engine throttles. The gearbox consists of a four-shaft, three-stage, heavy-duty gear train. The gear train input-output reduction ratio is 344 to 1.

A splined shaft approximately 10 inches long is provided with the gearbox. The shaft couples the gearbox output to an interfacing clutch assembly. One end of the shaft is inserted inside the gearbox and the other end is coupled to the clutch assembly. The gearbox input gear is coupled to the autothrottle servo output shaft.

7. Longitudinal Accelerometer Unit

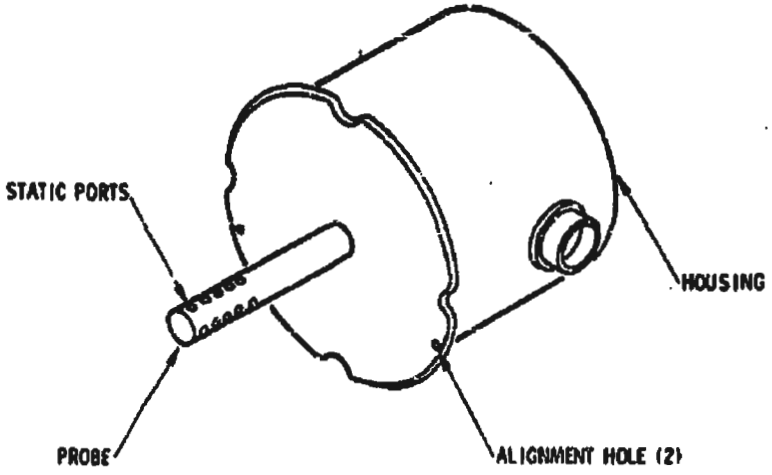
A. Description and Operation

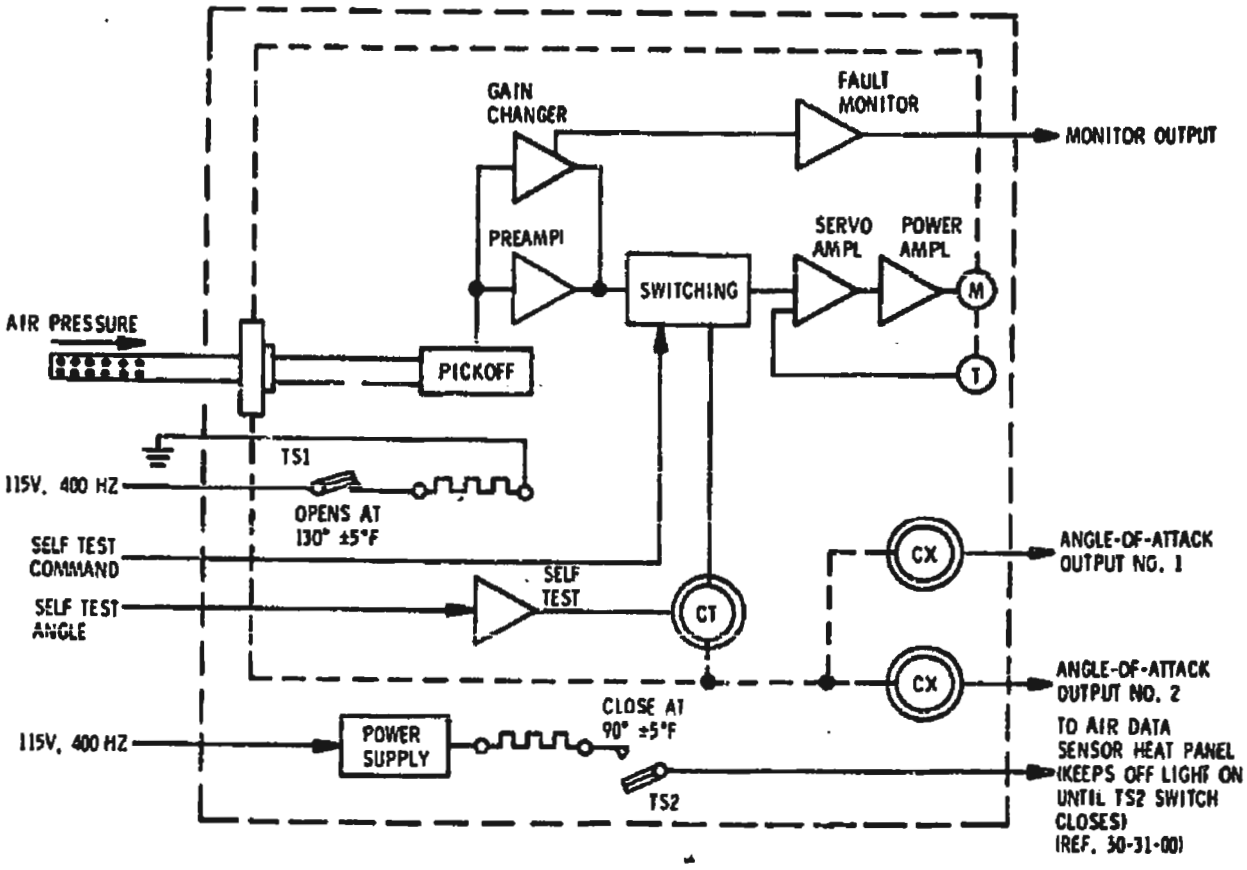
The longitudinal accelerometer unit is comprised of a mounting bracket and housing. The housing contains two identical horizontally mounted accelerometers. Two electrical receptacles are provided on the bracket, one for each accelerometer. The accelerometers are excited by +12V dc and -12V dc. A direction-of-flight arrow on the housing indicates which end of the unit is to be installed facing forward. The two accelerometers individually sense aircraft longitudinal accelerations and produce proportional positive voltages that are applied to the dual-channel equipment.

8. Angle-of-Attack Sensor

A. Description

The angle-of-attack sensor (Ref. Fig. 12) is a null-seeking pressure sensing, ac-servoed, position control transducer with a cylindrical probe used as the pressure generator. The probe, which projects from the sensor main housing, is provided with two rows of static pressure ports that are 90 degrees apart. The main housing consists of a differential pressure transducer (pickoff), amplifiers, a motor-tachometer, control transmitters, and a power supply to convert the sensed air pressure into angle-of-attack electrical signals. The sensor housing also contains the probe heater (Ref. 30-31-00), the fault monitor, and the self-test circuits. An electrical receptacle is provided on the side of the housing. Heavy-duty ball bearings are provided to assure free rotation of the probe.





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R Angle-of-Attack Sensor
R Figure 12

EFFECTIVITY: ALL

001B

B. Operation

Differences in air pressure, sensed by the two rows of static pressure ports, are converted into an electrical error signal by the pickoff (Ref. Fig. 12). The error signal is amplified by the preamplifier (gain is attenuated as a function of the error signal by the gain changer). The gain changer also limits the preamplifier output to a predetermined maximum signal level. The preamplifier output signal is applied through the servoamplifier and power amplifier to the servomotor. The servomotor rotates the probe for alignment with the airstream, which nulls the pressure signal. The tachometer feedback signal is used to control the damping ratio. The two synchro control transmitters follow the motion of the probe and transmit the angle-of-attack signals.

The fault monitor provides a caution signal when it detects a sensor failure. The monitoring function is provided for probe rotation, the pickoff, the amplifier, the servomotor, and the power supply. The monitor also senses if the probe is more than a few tenths-of-a-degree off aerodynamic null in flight for more than a fraction of a second. The fault monitor provides a 28V dc output signal under normal sensor operation, and a 0V dc caution signal if a fault is detected in the sensor.

Engagement of the self-test mode results in switching of the servoamplifier input from actual error signal to a self-test angle error signal. The error between the probe position and the self-test angle input is determined by a control transformer. The error is applied to the servomotor through the servoamplifier and power amplifier. The servomotor rotates the probe to the self-test position, which nulls the error signal. The control transmitter outputs are now the self-test angle outputs.

9. Speed Control Computer

A. Description

The speed control computer is housed in a 3/4 ATR long case. The computer front panel includes a fault isolation monitor indicator and a carrying handle. Mounting lugs are provided to secure the computer to the mounting rack. Two dual electrical receptacles are provided on the rear of the computer.

The computer consists of a chassis on which all functional modules are either mounted or plugged in. The plug-in module boards are inserted into a side plane interconnect

from the right side (with respect to the front of the computer). The chassis has provisions for a maximum of 17 plug-in module boards. Two power transformers are mounted on the rear of the chassis.

10. Autothrottle Disengage Switch

A. Description and Operation

The autothrottle disengage switch is a normally closed momentary pushbutton switch. The switch is used for quick disengagement of the autothrottle. When the switch is depressed, the autothrottle engage circuit is disabled.

11. Power Control Lever Switches

A. Description and Operation

The power control lever switches are cam-operated microswitches which provide signals representing engine thrust conditions to the applicable aircraft systems. The switches are grouped in three functionally identical sections and are located below the autothrottle clutch assemblies. The three sections correspond to the three engine power controls. Each section consists of 12 switches controlled by 6 reel-type cams, each cam controlling 2 switches. The cams are ganged together and linked to the associated autothrottle clutch assembly with pushrods, an idler, and a crank. The cams are configured to activate different switches, depending on the position of the clutch assembly which is either driven manually or by the autothrottle command signals. (Refer to 76-11-06 for mechanical details of switches.)

Three switches in each section (a total of 9) are associated with the autothrottle system:

Minimum thrust limit switch (Position No. 5)

Idle disconnect switch (Position No. 4)

Reverse thrust interlock switch (Position No. 12)

The three minimum thrust limit switches prevent low thrust settings which result in long acceleration periods when rapid acceleration is required. Each switch is activated by a cam as the associated power control is driven to minimum (50°). The activated switch sends a minimum thrust position signal to autothrottle. The autothrottle logic circuit

requires that a minimum thrust position signal be received from any two switches to inhibit the servo drive.

The three idle disconnect switches automatically disengage autothrottle after touchdown. Each switch is activated by a cam as the associated power control is driven to the idle position. When any two switches are activated, the autothrottle engage logic circuit receives an idle disconnect signal. The signal(s) causes engage logic circuit to deactivate the autothrottle.

The three reverse thrust interlock switches and autothrottle disengage switches are all electrically connected in series in the autothrottle engage circuit. When the power control levers are placed in the reverse thrust position (42°), cams open the reverse thrust interlock switches, breaking the autothrottle engage circuit. This ensures that the autothrottle is disengaged during reverse thrust operation.

12. System Interface

The speed control system interfaces with the following equipment:

34-14-00 Air Data Computer

34-21-00 Attitude Direction Indicator

22-10-00 AFCS MODES Annunciator

22-10-00 AFCS WARNING Indicator

22-17-00 FCES Computer

22-10-00 FCES Panel

27-51-00 Flap Actuator Position Transducers (Flap Actuator Power Drive Unit)

27-51-00 Flap Switches (Flap Actuator Power Drive Unit)

27-81-00 Leading Edge Slats Switches (Slats PDU Switch Pack)

22-11-00 Normal Accelerometer Unit

22-11-00 Pitch Computer

34-32-00 Radio Altimeter

22-13-00 Roll Computer

27-11-00 Takeoff/Go-Around Switch (Control Wheel)

22-18-00 Trim Augmentation Computer

34-21-00 Vertical Gyros

SPEED CONTROL SYSTEM - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting the Speed Control/Autothrottle system faults are included in this section of the manual. A speed control or autothrottle malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code. This fault code and the flight log book report can be found in the Chapter 22 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a fault number indicating the diagram entry point containing the fault isolation procedure. When no fault number is specified, use Figure 103 fault identification or Table 102 fault isolation.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring manual pages required for checking component interconnect wiring.

Speed control system fault isolation contains two levels of troubleshooting: (1) Fault oriented, and (2) system oriented. Fault oriented fault isolation (Ref. Paragraph 4A) trouble shoots a specific speed system problem. System oriented fault isolation (Ref. Paragraph 4B) tests and trouble shoots the speed system.

2. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices

3. Equipment and Materials

R Breakout Cable Assembly for Speed Control Computer, G/ITEL No. 22-00-19 (See Figure 508, 22-12-37). (One Req.)

4. Fault Isolation Identification

Table 101 is a list of the speed control/autothrottle system fault isolation diagrams and schematics. Figure 101 and 102

provide component location to speed control/autothrottle troubleshooting.

Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Autothrottle/Speed System Fault Identification
104	Single ATS FAIL Light Faults
105	ATS DISC/Dual FAIL Light Faults
106	Other Autothrottle/Speed System Faults
SCHEM 1	Speed Control Computer Power Distribution
SCHEM 2	Autothrottle Signal Flow
SCHEM 3	Takeoff/Go-Around Signal Flow
SCHEM 4	Autothrottle Switching and Alpha Annunciation Logic
SCHEM 5	Takeoff/Go-Around Switching Logic
SCHEM 6	Autothrottle Engage and Disconnect Warning Logic
SCHEM 7	Autothrottle Interlock and Motor Control Enable Logic
SCHEM 8	Takeoff/Go-Around Valid and No Go-Around Annunciation Logic
SCHEM 9	Speed Control System Turn On and Monitor Logic
SCHEM 10	Speed Control Computer FIM Logic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
ACCELEROMETER – LONGITUDINAL	1	GALY CLG/135DB	22-31-05
ACCELEROMETER – NORMAL	1	GALY CLG/135DB	22-11-02
ACCESSORY UNIT – AFCS/MLG	1	FESC, CTR RACK/112AB	22-10-11
COMPUTER – AIR DATA (ADC)	2	FESC, REAR RACK/112AB	34-14-01
COMPUTER – FCES	1	FESC, CTR RACK/112AB	22-17-01
COMPUTER – PITCH	2	FESC, CTR RACK/112AB	22-11-01
COMPUTER – ROLL	2	FESC, CTR RACK/112AB	22-13-01
COMPUTER – SPEED CONTROL	1	FESC, CTR RACK/112AB	22-31-07
COMPUTER – TRIM AUGMENTATION	1	FESC, CTR RACK/112AB	22-18-01
CONTROL BOX – INDICATOR LIGHTS	1	FESC, AFT OF ELEC RACK/112AB	33-17-04
GEARBOX – AUTOTHROTTLE SERVO	1	FESC, FWD OVHD/112AB	22-31-04
GYRO – VERTICAL ATTITUDE REFERENCE (1)	2	FESC, FWD RACK/112AB	34-21-04
INDICATOR – ATTITUDE DIRECTOR	2	FLT STA, PLT INSTPN	34-21-07
NAVIGATION UNIT – INERTIAL (2)	2	FESC, FWD RACK/112AB	34-43-03
PANEL – THRUST SELECT	1	FLT STA, GLRSHLD PNL	22-31-03
RCVR – XMTR RADIO ALTIMETER	2	MESC, L & R RACKS/192K	34-32-01
SENSOR – ANGLE OF ATTACK	2	EXT, L & R/FS 215	22-31-05
SERVO AUTOTHROTTLE	1	FESC, FWD OVHD/112AB	22-31-01
SERVO – DIRECT LIFT CONTROL	1	HSC, AFT CTR/147AB	27-61-06
SWITCH AUTOPILOT DISCONNECT	2	FLT STA, CONT WHL	22-10-21
SWITCH AUTOTHROTTLE DISC IDLE	3	FESC, FWD OVHD/112AB	76-11-06
SWITCH AUTOTHROTTLE DISENGAGE	2	FLT STA, THROT LVR 1 & 3	22-31-09
SWITCH AUTOTHROTTLE RVS THR INTLK	3	FESC, FWD OVHD/112AB	76-11-06
SWITCH MINIMUM THRUST	3	FESC, FWD OVHD/112AB	76-11-06
SWITCHBOX – FLAP POWER DRIVE UNIT	2	HSC, ON FLAP PDU/147AB	27-51-12
SWITCHBOX SLAT POWER DRIVE UNIT	2	LEFT WING BUTT/511BT	27-81-08
VALVE ELECTROHYDRAULIC SERVO	2	HSC, ON DLC SERVO/147AB	27-61-07

EFFECTIVITY

(1) 001-024, 027

(2) 025, 026, 028-999

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Component Location Index
Figure 101

EFFECTIVITY: ALL

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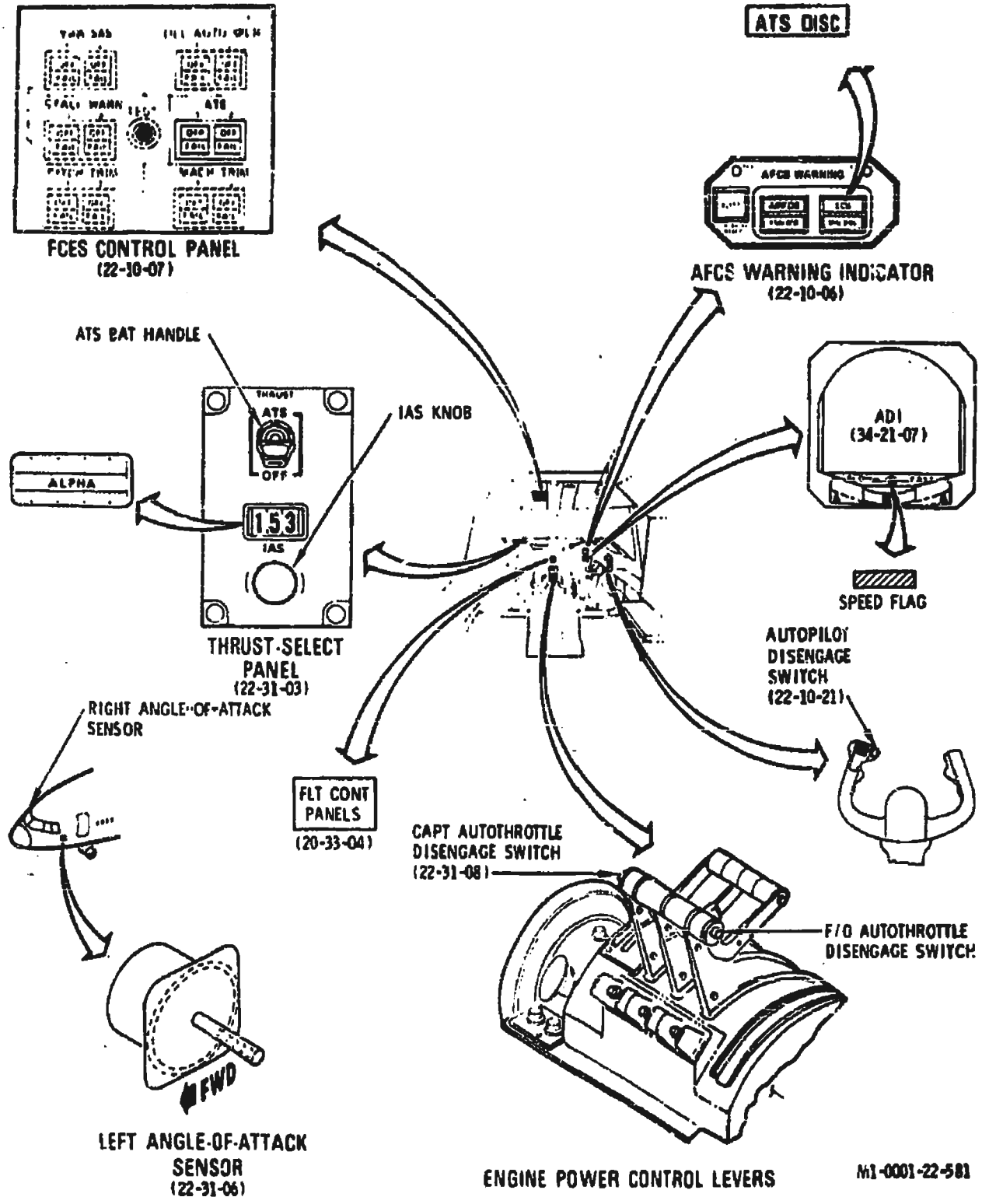
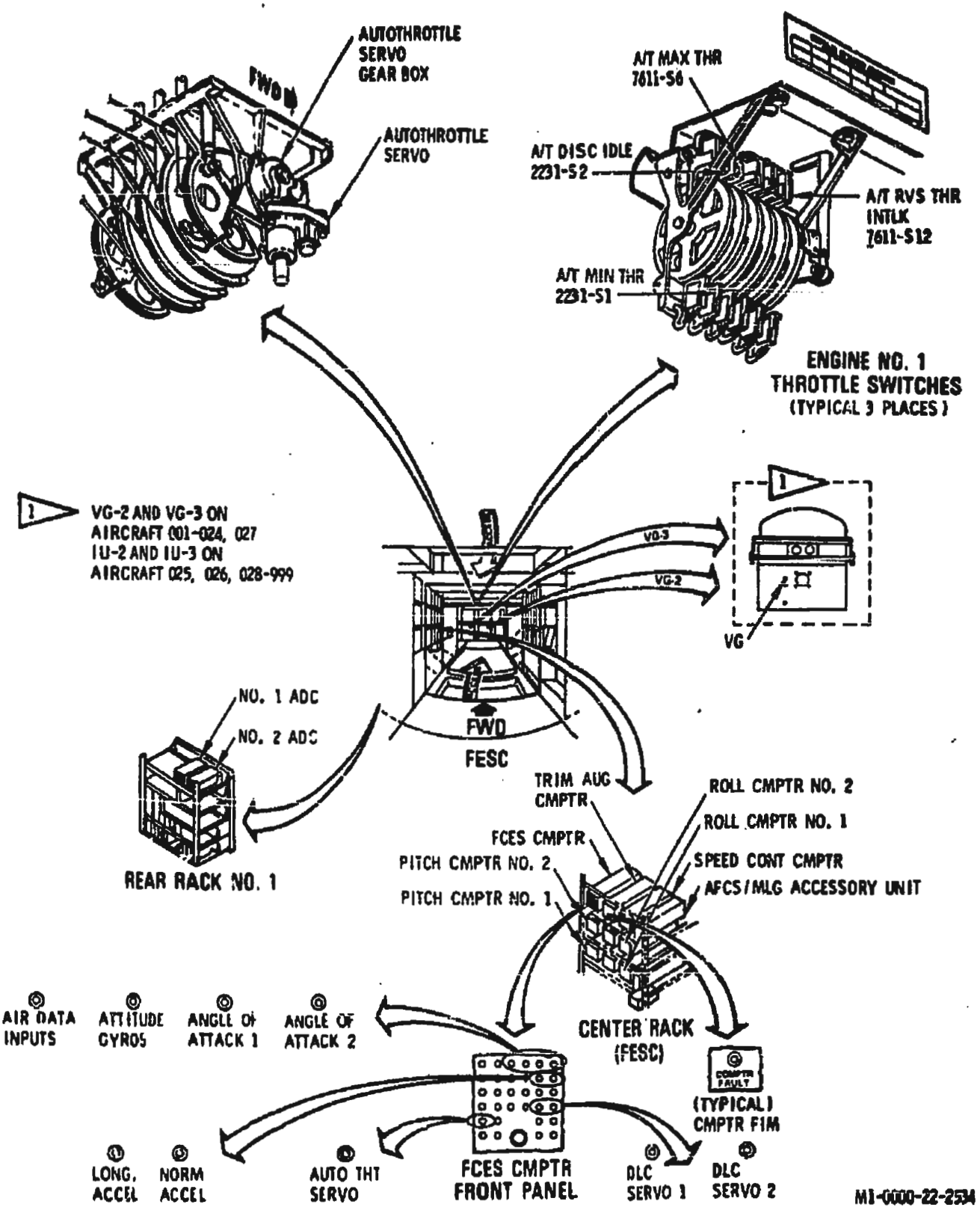


R Component Locator Diagram
R Figure 102 (Sheet 1)

EFFECTIVITY: ALL

001B



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Component Locator Diagram
Figure 102 (Sheet 2)

EFFECTIVITY: ALL

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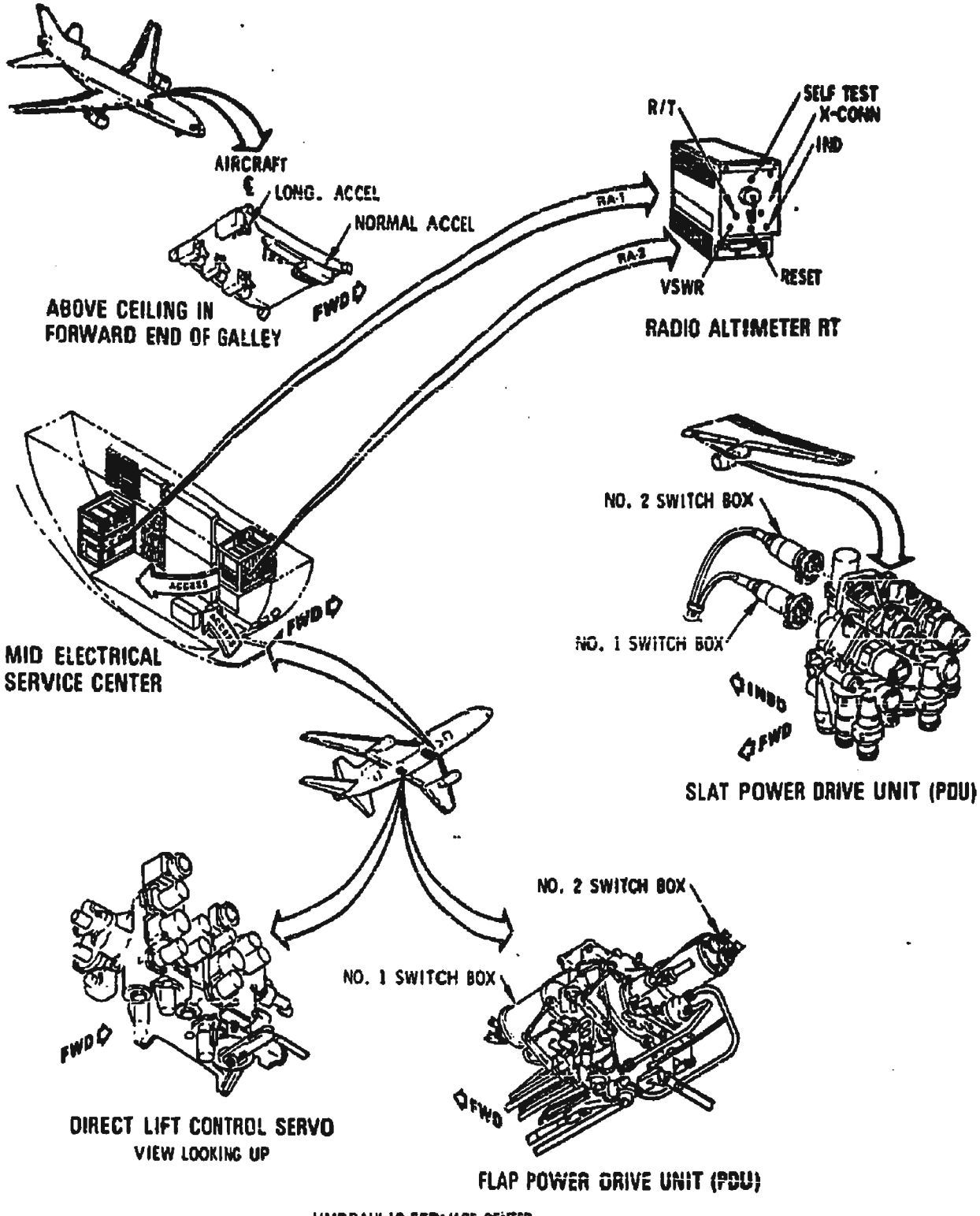

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Component Locator Diagram
Figure 102 (Sheet 3)

EFFECTIVITY: ALL

001B

R A. Fault Oriented Fault Isolation

R Fault oriented fault isolation is geared to a reported
R malfunction which is a result of a single failure. Figure
R 103 identifies a fault within the autothrottle/speed system
R by a specific fault number. It also identifies and locates
R the LRUs which can cause the problem. For faults not listed
R in Figure 103, perform System Oriented Fault Isolation in
R Paragraph 4B to isolate problem.

R Figures 104, 105, and 106 provide diagnostic steps to
R further isolate the fault. The diagnostic steps are in a
R flow chart form which contains complete fault isolation
R procedures for each fault. Action instructions are
R contained within the blocks of the flow chart while the
R monitored results of the actions are outside the blocks.
R When using the flow charts, it is assumed that systems are
R in the normal operational mode, all relevant circuit
R breakers have been checked, and all applicable aircraft
R operational procedures have been accomplished.

FAULTS		FIM												NO FIM	
		Troubleshooting Faulty LRU													
		Check FIM on LRU or on Front Panel of FCES Cmptr											Cont Chk or Replace		
No.	Problem	SC	LA	ADC	NA	PC	AOA	IU	DLC S	FS	TAC	AT S	TP	FL SB	SL SB
"SINGLE ATS FAIL LIGHT" FAULTS (Ref. Fig. 104)															
1	ATS 1 FAIL light on	X	1	1											
2	ATS 1 FAIL light on (alpha mode). AP A locked off	X			1	1									
3	ATS 1 and STALL WARN 1 Fail lights on						1								
4	ATS 1 FAIL light on, ATT 3 legend on							3							
5	ATS 1, MACH TRIM 1, MACH FEEL 1 FAIL lights on. Capt AS, MACH, SSC flags			1											
6	ATS 2 FAIL light on	X	2	2											
7	ATS 2 FAIL light on (A/S mode). AP B locked off							2							
8	ATS 2 FAIL light on (alpha mode). AP B locked off	X			2	2									
9	ATS 2 and STALL WARN 2 FAIL lights on						2								
10	ATS 2 FAIL light on. F/O ATT flag							2							
11	ATS 2, MACH TRIM 2, MACH FEEL 2 FAIL lights on. F/O AS, MACH, SSC flags			2											
"ATS DISC/DUAL ATS FAIL LIGHTS" FAULTS (Ref. Fig. 105)															
20	Both ATS FAIL lights on (A/S mode). Single chan opn OK	X	1/2	1/2				2/3					X	1/2	
21	Both ATS FAIL lights on (alpha mode). Single chan opn OK	X	1/2	1/2	1/2		1/2	2/3	X	X			X		
22	Both ATS FAIL lights on. VERTICAL GYRO 3 legend on. Single chan opn OK							3							
23	Both ATS FAIL lights on. F/O ATT flag Single chan opn OK							2							
24	Both ATS FAIL lights on. Either DLC/AUTO SPLR FAIL light on. Single chan opn OK								X	X					
25	All ATS, MACH TRIM and/or both MACH FEEL FAIL lights on. Single chan opn OK			1/2											
26	Both ATS FAIL lights on. Both SPLED flags in view.	X													
27	All ATS, PITCH TRIM, MACH TRIM MACH FEEL FAIL lights on. If engaged ATS bat handle remains engaged										X				
28	Both ATS FAIL lights on		1/2												
29	ATS DISC and message. No other faults	X										X	X		
30	ATS DISC message, ATS bat handle remains engaged	X											X		
31	ATS retards (advances) throttle normally. But in opposite directions, disconnects throttle.	X													
32	Both ATS FAIL lights on. Single channel operation not OK. ALT HA flag in view	X													1/2

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R Autothrottle/Speed System Fault Identification
R Figure 103 (Sheet 1)

FAULTS		FIM					NO FIM								
		Troubleshooting Faulty LRU													
		Check FIM on LRU or on Front Panel of FCES Cmptr					Continuity Check or Replace								
No.	Problem	SC	AT S	FC		RA	TP	ADI	S12	AT DISC	AP DISC	S1	FL S8	AIR/ GND	S2
"OTHER AUTOTHROTTLE/SPEED SYSTEM" FAULTS (Ref. Fig. 106)															
41	Throt do not stop at min pos	X										X			
42	Throt do not drive to IDLE at touchdown	X		X		1/2								X	
43	AT DISC sw inop	X								1/2	1/2				
44	Capt or F/O FAST/SLOW pointer inop or erratic	X						1/2							
45	Capt or F/O FAST/SLOW needle out of view	X													
46	Capt or F/O SPEED flag in view	X						1/2							
47	ATS bat handle locked off. No other fault indication	X					X		X	1/2	1/2				
48	ATS does not DISC at touchdown	X													X
49	Alpha flag in A/S mode	X					X								
50	IAS Knob – loose, rough, sticks						X								
51	No ALPHA flag in alpha mode	X					X						1/2		
52	Speed too high in alpha mode. Speed V_{REF} +10 or +20 (should be V_{REF} +2 to +5). No other cockpit indications	X													
53	Throttles will not drive together (throttle lagging)														
54	Throttles drive abruptly erratic or hardover	X	X												

NOTE

1 Airspeed (A/S) mode = flaps less than 30°, and IAS greater than 1.3 Vs.
2 Alpha mode = flaps greater than 30°, or IAS less than 1.3 Vs.
3 Single chan open OK = either channel will operate with other channel turned OFF. Both channels FAIL when both turned on.
4 To simply fault table, following indications are omitted:
- FAST/SLOW needle biased out-of-view on side of ATS FAIL light. When both ATS fail, both needles are biased out of view.
- When both ATS FAIL, ATS DISC and message occurs if engaged. The one exception is a TAC power fault.

HOW TO USE

1 Find fault squawk in FAULTS column
2 Check FIM or LRU listed in FIM column related to FAULTS. Black FIM = LRU good; White or Yellow FIM = Replace LRU
3 If NO FIM indicated: RESEAT computers listed in FIM column related to FAULTS.
4 If problem persists: Refer to Fig. 104 or 105 or 106

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R Autothrottle/Speed System Fault Identification
R Figure 103 (Sheet 2)

Abbreviations		Remove and Install Ref.	
		Chapt	Page
ADC	Air data computer	34-14-01	401
ADI	Attitude director indicator	34-21-07	401
AIR/GND	AFCS/MLG accessory unit	22-10-11	401
AOA	Angle of attack sensor	22-31-06	401
AP DISC	Autopilot disconnect switch (control whl)	22-10-21	401
AT DISC	Autothrottle disconnect switch	22-31-08	401
AT S	Autothrottle servo	22-31-01	401
DLC S	Direct lift control servo	27-61-06	401
FC	FCES computer	22-17-01	401
FL SB	Flap PDU switch box	27-51-12	401
LA	Longitudinal accelerometer unit	22-31-05	401
NA	Normal accelerometer	22-11-02	401
PC	Pitch computer	22-11-01	401
RA	Radio altimeter RT	34-32-01	401
RC	Roll computer	22-13-01	401
SC	Speed control computer	22-31-07	401
SL SB	Slat PDU switch box	27-81-08	401
S1	A/T MIN THR switch (2231-S1)	22-31-09	401
S2	A/T DISC IDLE switch (2231-S2)	22-31-09	401
S6	A/T MAX THR switch (7611-S6)	22-31-09	401
S12	A/T RVS THR INTLK switch (7611-S12)	22-31-09	401
TAC	Trim augmentation computer	22-18-01	401
TP	Thrust select panel	22-31-03	401
VG	Vertical gyro or	34-21-04	401
	inertial sensor unit or inertial NAV unit	34-43-03	401
X	One LRU common to both sys		
1	No. 1 LRU associated with sys 1 problem		
2	No. 2 LRU associated with sys 2 problem		

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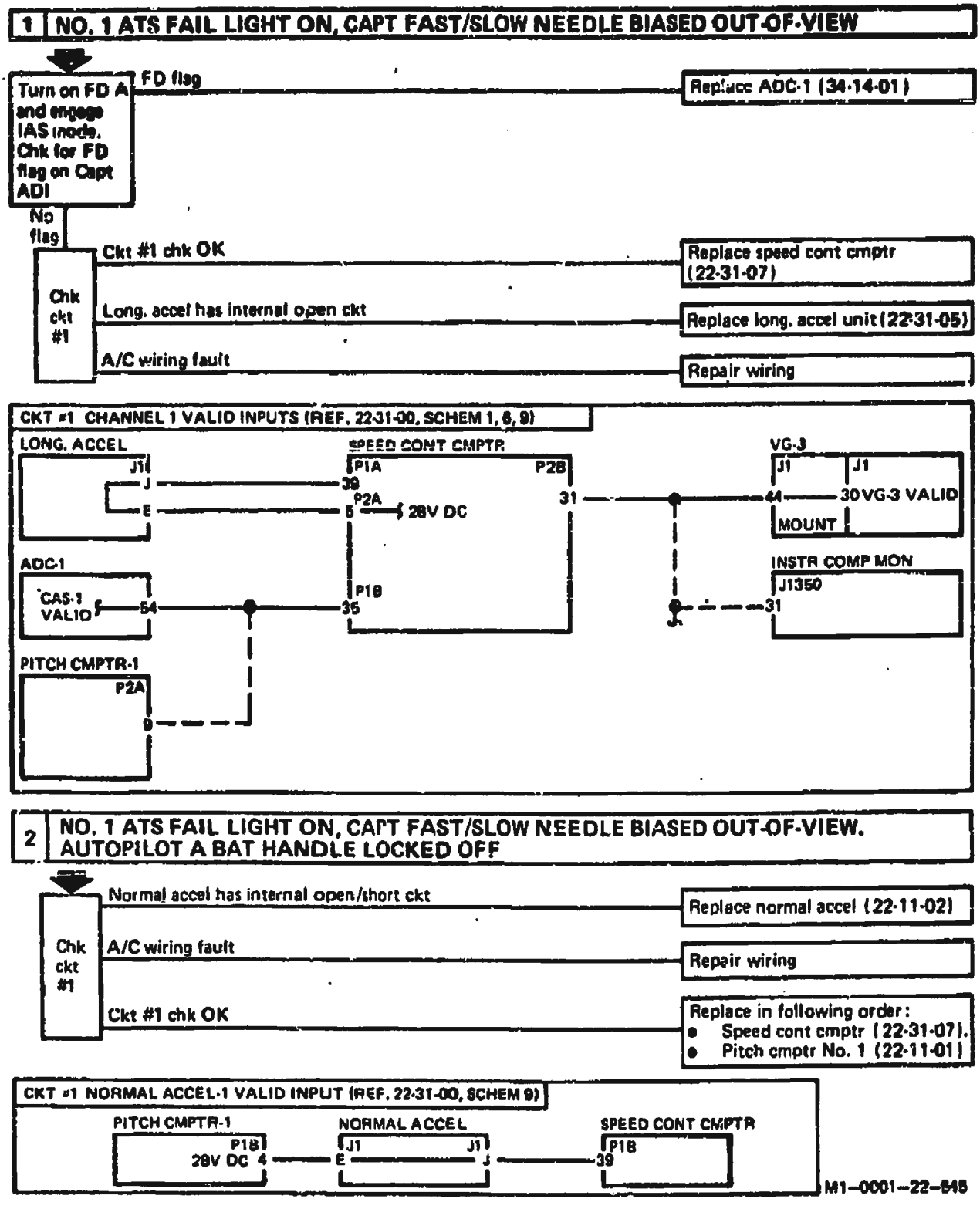
R Autothrottle/Speed System Fault Identification
R Figure 103 (Sheet 3)



R Single ATS FAIL Light Faults
R Figure 104 (Sheet 1)

EFFECTIVITY: ALL

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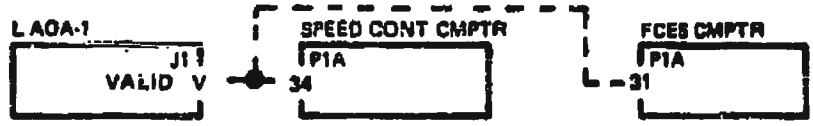
3	NO. 1 ATS AND NO. 1 STALL WARN FAIL LIGHTS ON. CAPT FAST/SLOW NEEDLE BIASED OUT OF VIEW

Angle-of-attack 1 FIM on FCES cmptr

Replace left AOA sensor 1 (22-31-08). If problem persists, chk ckt #1

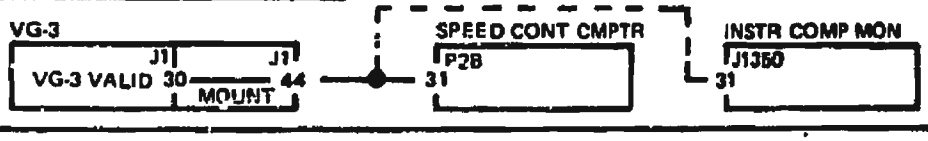
CKT #1 AOA-1 VALID (REF. 22-31-00, SCHEM 4, 9)



4	NO. 1 ATS FAIL LIGHT ON, CAPT FAST/SLOW NEEDLE BIASED OUT OF VIEW. VERTICAL GYRO 3 LEGEND ON

Replace vertical gyro No. 3 (22-21-04). If problem persists, chk ckt #1

CKT #1 VG-3 VALID (REF. 22-31-00, SCHEM 9)



5	NO. 1 ATS, NO. 1 MACH TRIM, NO. 1 MACH FEEL FAIL LIGHTS ON. CAPT FAST/SLOW NEEDLE BIASED OUT-OF-VIEW. CAPT MACH/AIRSPEED IND AS AND MACH FLAGS IN VIEW. CAPT BARO ALTIMETER SSC FLAG IN VIEW.

Replace ADC-1 (34-14-01)

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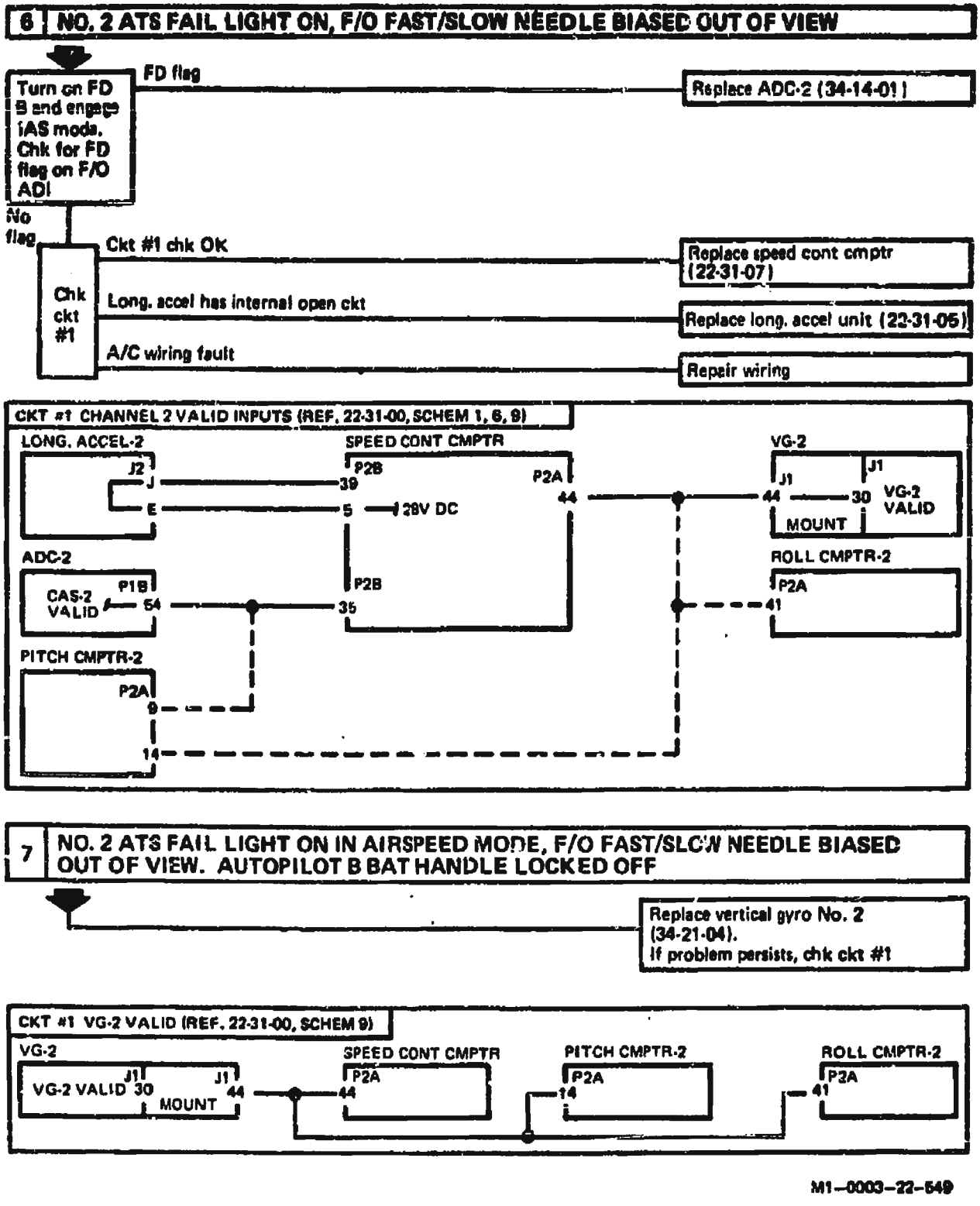
R Single ATS FAIL Light Faults
R Figure 104 (Sheet 2)

EFFECTIVITY: ALL



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R Single ATS FAIL Light Faults
R Figure 104 (Sheet 3)

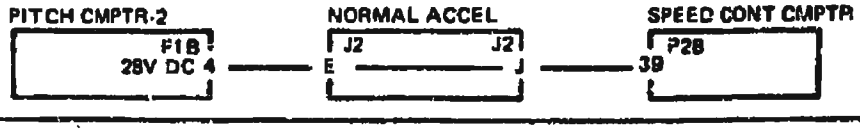
EFFECTIVITY: ALL

8 NO. 2 ATS FAIL LIGHT ON IN ALPHA MODE AND F/O FAST/SLOW NEEDLE BIASED OUT-OF-VIEW. AUTOPILOT B BAT HANDLE LOCKED OFF

Chk ckt #1

- Normal accel has internal open/short ckt → Replace normal accel (22-11-02)
- A/C wiring fault → Repair wiring
- Ckt #1 chk OK → Replace in following order:
  - Speed cont cmptr (22-31-07).
  - Pitch cmptr No. 2 (22-11-01)

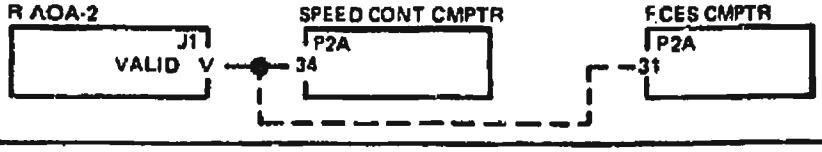
CKT #1 NORMAL ACCEL-2 VALID INPUT (REF. 22-31-00, SCHEM 9)



9 NO. 2 ATS AND NO. 2 STALL WARN FAIL LIGHTS ON, F/O FAST/SLOW NEEDLE BIASED OUT-OF-VIEW

- Angle-of-attack 2 FIM on FCES cmptr → Replace right AOA sensor 2 (22-31-06). If problem persists, chk ckt #1

CKT #1 AOA-2 VALID (REF. 22-31-00, SCHEM 4, 9)



10 NO. 2 ATS FAIL LIGHT ON, F/O FAST/SLOW NEEDLE BIASED OUT-OF-VIEW. F/O ADI ATT FLAG IN-VIEW

- → Replace vertical gyro No. 2 (34-21-04)

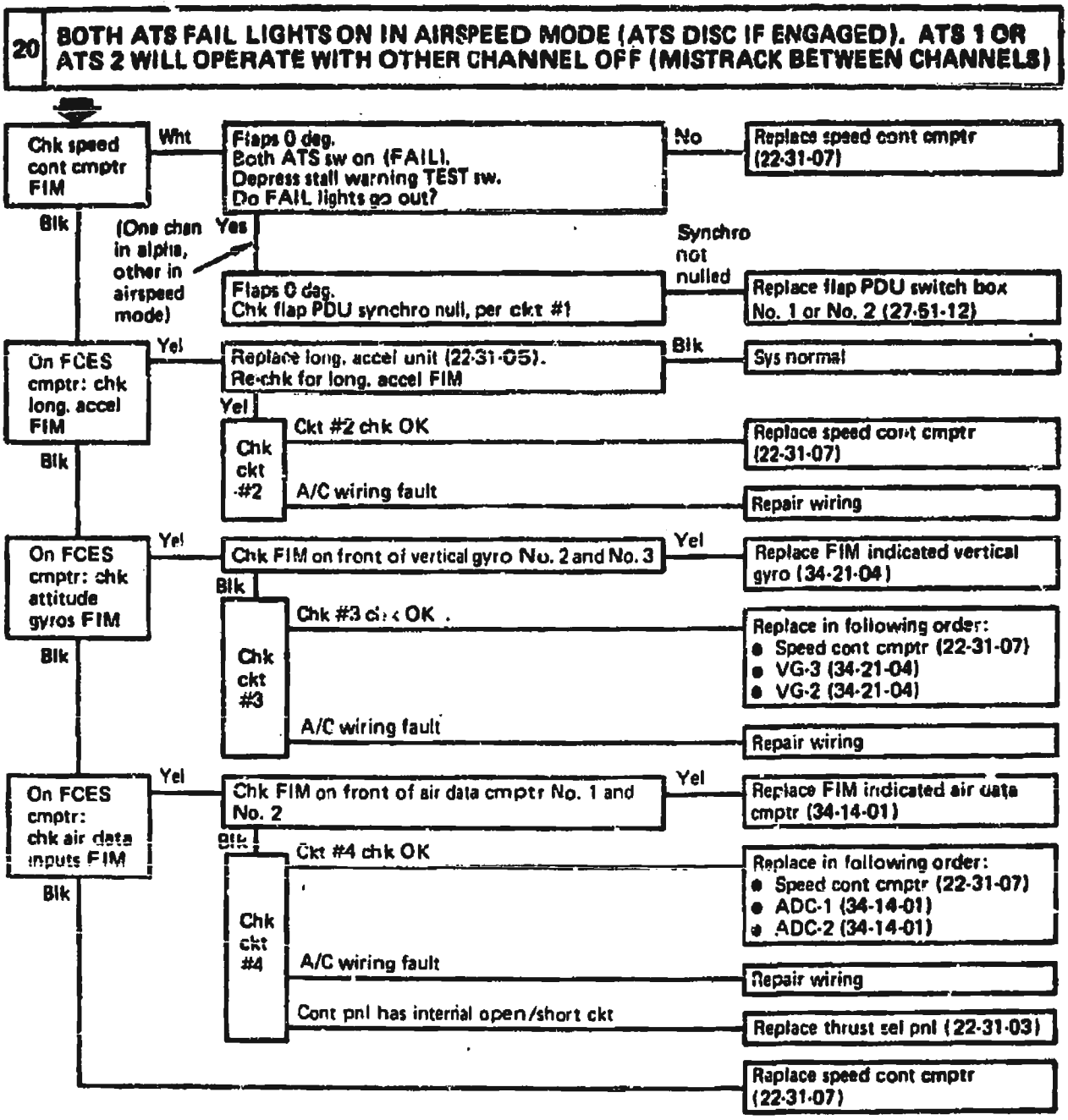
11 NO. 2 ATS, NO. 2 MACH TRIM, NO. 2 MACH FEEL FAIL LIGHTS ON. F/O FAST/SLOW NEEDLE BIASED OUT-OF-VIEW F/O MACH/AIRSPEED IND AS AND MACH FLAGS IN-VIEW. F/O BARO ALTIMETER SSC FLAG IN VIEW.

- → Replace ADC-2 (34-14-01)

M1-0002-22-581

R Single ATS FAIL Light Faults
R Figure 104 (Sheet 4)

EFFECTIVITY: ALL


20 BOTH ATS FAIL LIGHTS ON IN AIRSPEED MODE (ATS DISC IF ENGAGED). ATS 1 OR ATS 2 WILL OPERATE WITH OTHER CHANNEL OFF (MISTRACK BETWEEN CHANNELS)
Chk speed cont cmptr FIM
Wht
Flaps 0 deg.
Both ATS sw on (FAIL).
Depress stall warning TEST sw.
Do FAIL lights go out?
No
Replace speed cont cmptr (22-31-07)
Blk
(One chan in alpha, other in airspeed mode)
Yes
Synchro not nulled
Flaps 0 deg.
Chk flap PDU synchro null, per ckt #1
Replace flap PDU switch box No. 1 or No. 2 (27-51-12)
On FCES cmptr: chk long. accel FIM
Yel
Replace long. accel unit (22-31-05).
Re-chk for long. accel FIM
Blk
Sys normal
Yel
Chk ckt #2
Ckt #2 chk OK
Replace speed cont cmptr (22-31-07)
A/C wiring fault
Repair wiring
Blk
On FCES cmptr: chk attitude gyros FIM
Yel
Chk FIM on front of vertical gyro No. 2 and No. 3
Yel
Replace FIM indicated vertical gyro (34-21-04)
Blk
Chk ckt #3
Ckt #3 chk OK
Replace in following order:
• Speed cont cmptr (22-31-07)
• VG-3 (34-21-04)
• VG-2 (34-21-04)
A/C wiring fault
Repair wiring
Blk
On FCES cmptr: chk air data inputs FIM
Yel
Chk FIM on front of air data cmptr No. 1 and No. 2
Yel
Replace FIM indicated air data cmptr (34-14-01)
Blk
Chk ckt #4
Ckt #4 chk OK
Replace in following order:
• Speed cont cmptr (22-31-07)
• ADC-1 (34-14-01)
• ADC-2 (34-14-01)
A/C wiring fault
Repair wiring
Cont pnl has internal open/short ckt
Replace thrust sel pnl (22-31-03)
Replace speed cont cmptr (22-31-07)

M1-0001-22-883

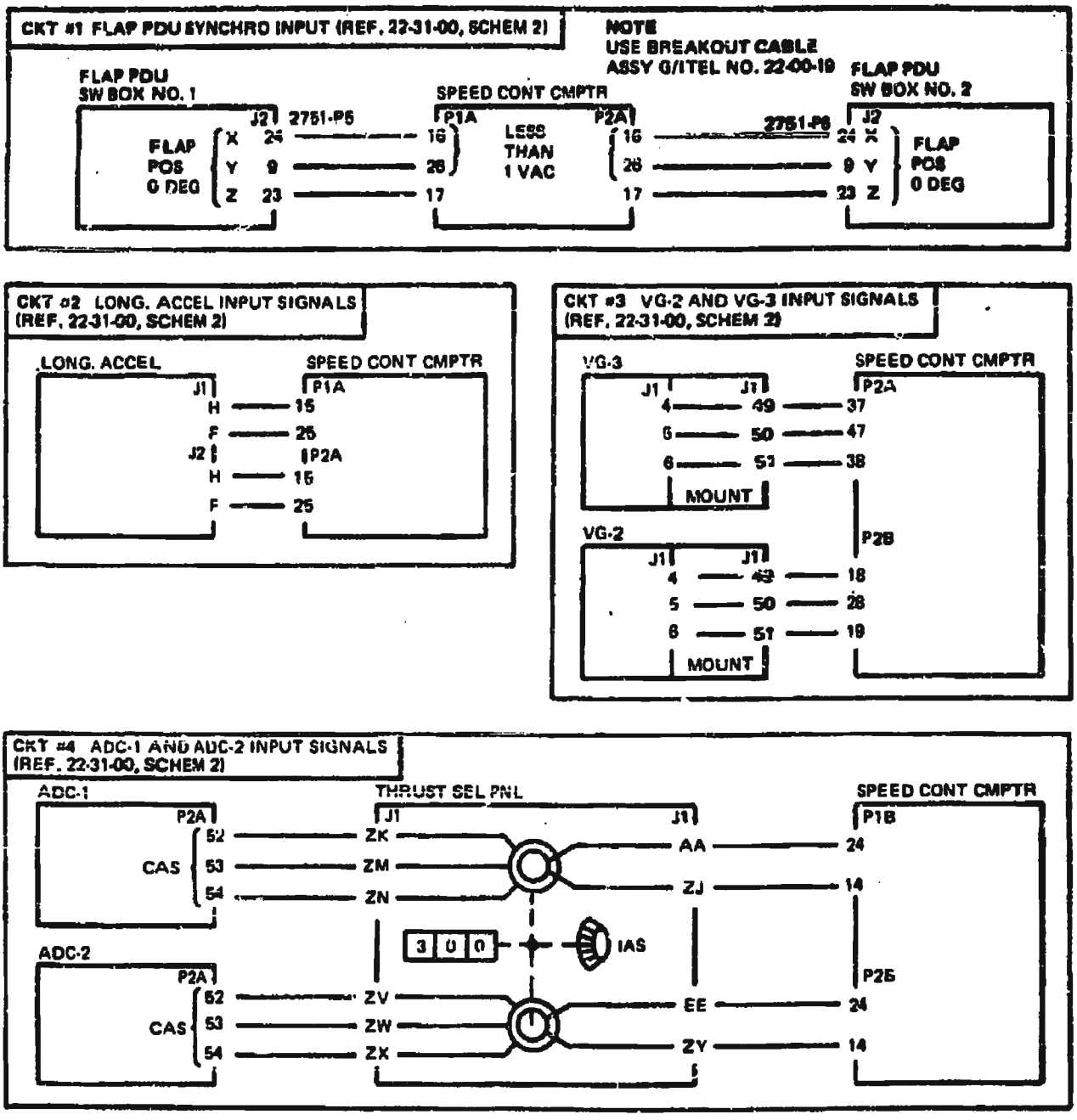
R
R

ATS DISC/Dual FAIL Lights Faults
Figure 105 (Sheet 1)

EFFECTIVITY: ALL

001B

20 CONTINUED

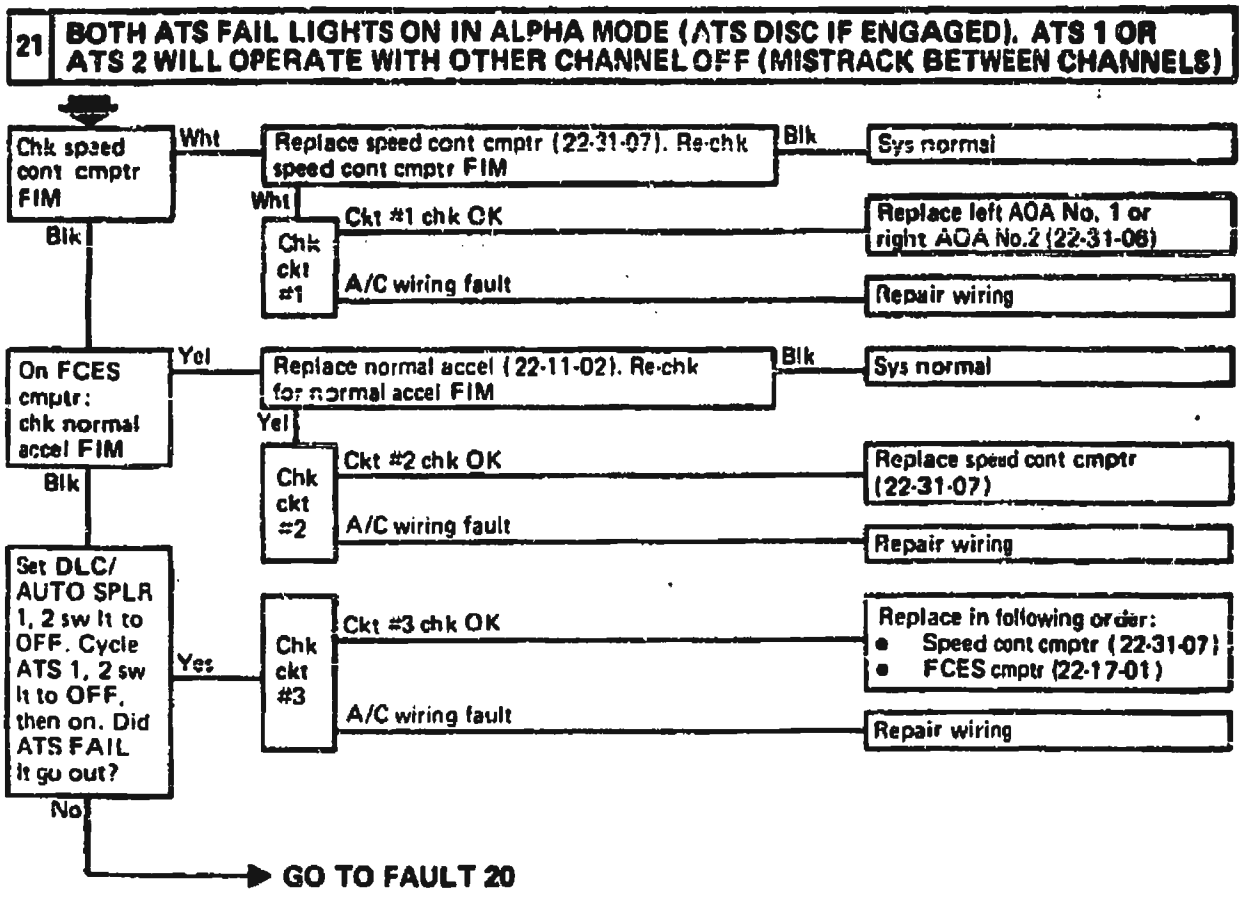


M1-0002-22-566

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 2)

EFFECTIVITY: ALL

001B


21 BOTH ATS FAIL LIGHTS ON IN ALPHA MODE (ATS DISC IF ENGAGED). ATS 1 OR ATS 2 WILL OPERATE WITH OTHER CHANNEL OFF (MISTRACK BETWEEN CHANNELS)
Chk speed cont cmptr FIM
Wht
Replace speed cont cmptr (22-31-07). Re-chk speed cont cmptr FIM
Blk
Sys normal
Wht
Chk ckt #1
Ckt #1 chk OK
Replace left AOA No. 1 or right AOA No.2 (22-31-06)
A/C wiring fault
Repair wiring
Blk
On FCES cmptr: chk normal accel FIM
Yel
Replace normal accel (22-11-02). Re-chk for normal accel FIM
Blk
Sys normal
Yel
Chk ckt #2
Ckt #2 chk OK
Replace speed cont cmptr (22-31-07)
A/C wiring fault
Repair wiring
Blk
Set DLC/ AUTO SPLR 1, 2 sw lt to OFF. Cycle ATS 1, 2 sw lt to OFF, then on. Did ATS FAIL lt go out?
Yes
Chk ckt #3
Ckt #3 chk OK
Replace in following order:
• Speed cont cmptr (22-31-07)
• FCES cmptr (22-17-01)
A/C wiring fault
Repair wiring
No
GO TO FAULT 20

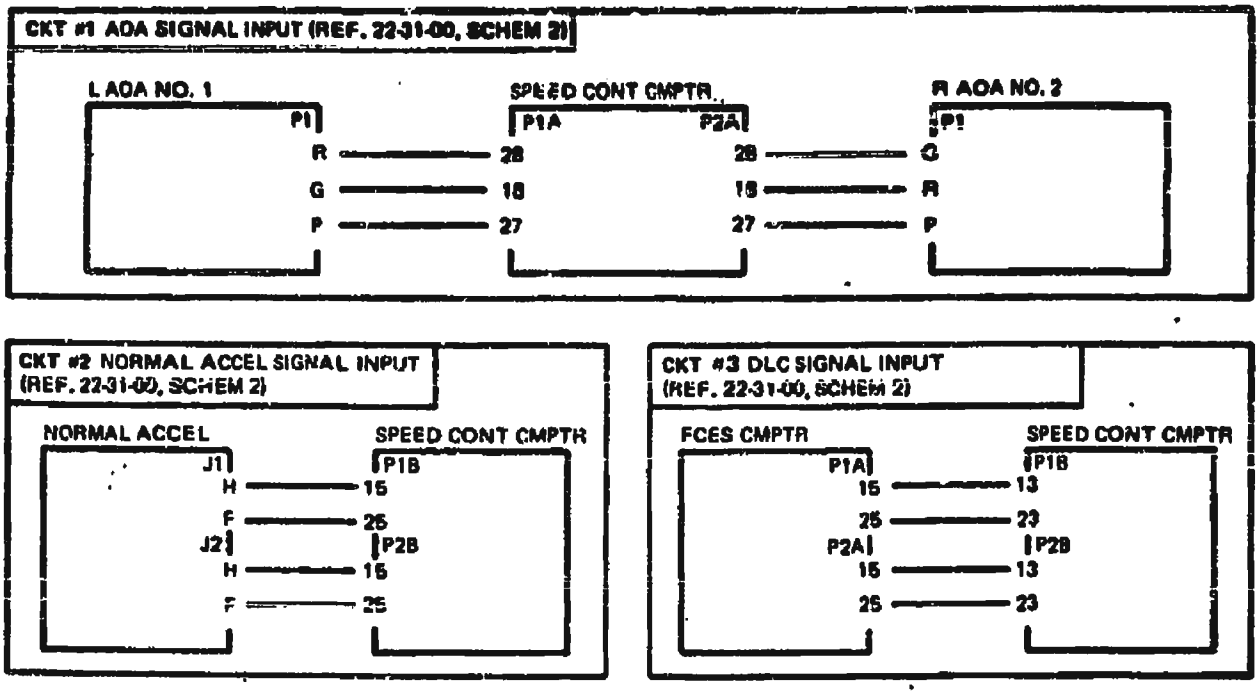
M1-0002-22-559

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 3)

EFFECTIVITY: ALL

001B

21 CONTINUED



M1-0002-22-880

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 4)

EFFECTIVITY: ALL

0016

22	BOTH ATS FAIL LIGHTS ON (ATS DISC IF ENGAGED). ATS 1 OR ATS 2 WILL OPERATE WITH OTHER CHANNEL OFF (MISTRACK BETWEEN CHANNELS). "VERTICAL GYRO 3" FAIL LEGEND ON.

Attitude gyros FIM on FCES cmptr → Replace VG-3 (34-21-04)

23	BOTH ATS FAIL LIGHTS ON (ATS DISC IF ENGAGED). ATS 1 OR ATS 2 WILL OPERATE WITH OTHER CHANNEL OFF (MISTRACK BETWEEN CHANNELS). ATT FLAG (F/O ADI) IN VIEW

Attitude gyros FIM on FCES cmptr → Replace VG-2 (34-21-04)

M1-47900-22-561

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 5)

EFFECTIVITY: ALL

001B

24	BOTH ATS FAIL LIGHTS ON (ATS DISC IF ENGAGED). EITHER DLC/AUTO SPLR 1 OR 2 FAIL LIGHT ON. ATS 1 OR ATS 2 WILL OPERATE WITH OTHER CHANNEL OFF (MISTRACK BETWEEN CHANNELS).

On FCES cmptr: chk DLC servo FIM

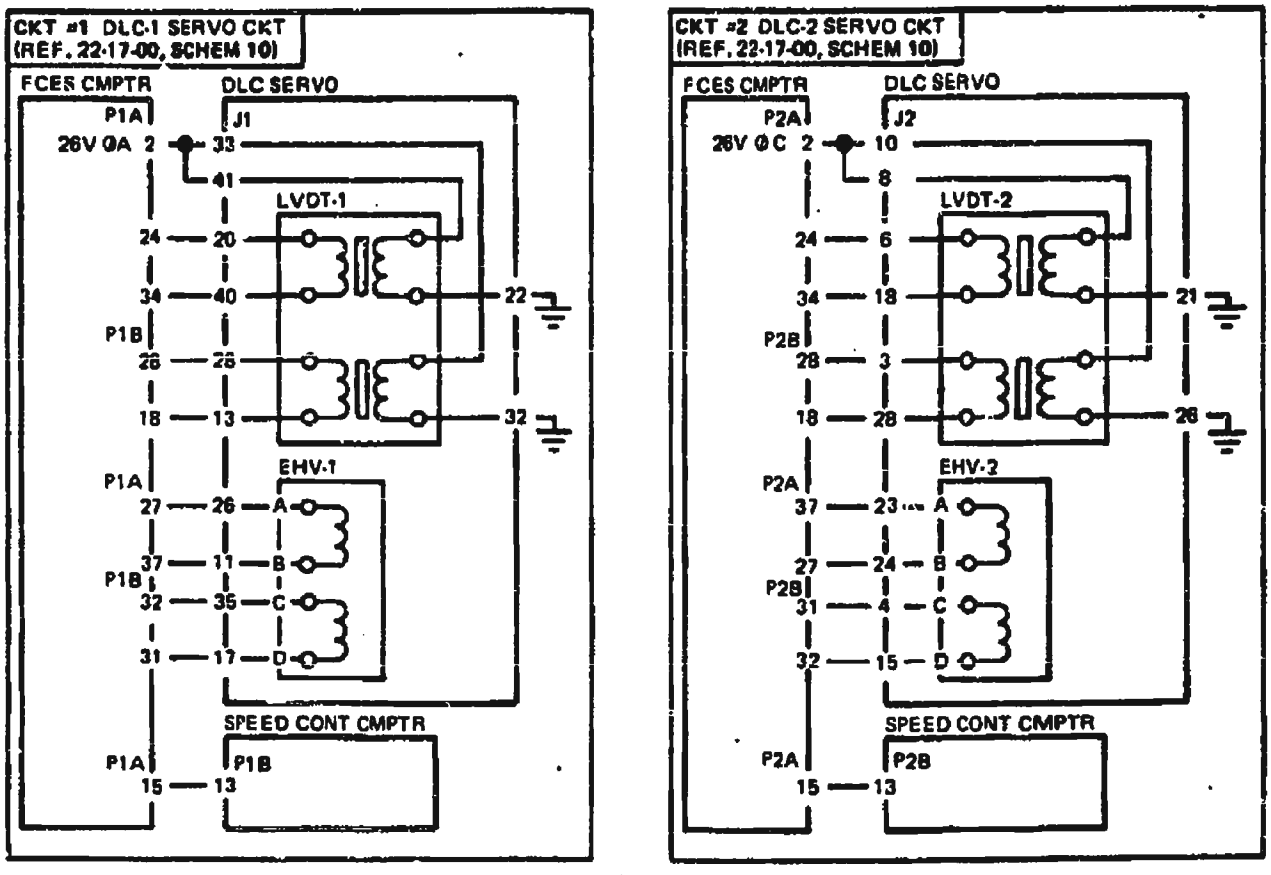
1 or 2 yel

1 and 2 Blk

Chk ckt #1 for DLC-1 and #2 for DLC-2

- Ckt #1 or #2 chk OK → Replace FCES cmptr (22-17-01). If problem persists, replace EHV (27-61-07). If problem persists, replace DLC servo (27-61-06)
- DLC servo has internal open/short ckt → Replace DLC servo (27-61-06)
- A/C wiring fault → Repair wiring

→ GO TO FAULT 21

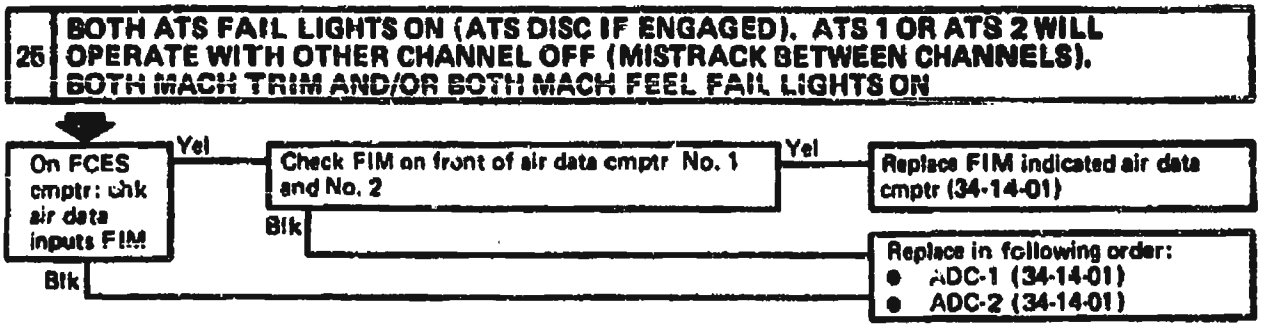


M1-0002-22-584

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 6)

EFFECTIVITY: ALL

001B


25
BOTH ATS FAIL LIGHTS ON (ATS DISC IF ENGAGED). ATS 1 OR ATS 2 WILL OPERATE WITH OTHER CHANNEL OFF (MISTRACK BETWEEN CHANNELS). BOTH MACH TRIM AND/OR BOTH MACH FEEL FAIL LIGHTS ON
On FCES cmptr: chk air data inputs FIM
Yel
Check FIM on front of air data cmptr No. 1 and No. 2
Yel
Replace FIM indicated air data cmptr (34-14-01)
Blk
Blk
Replace in following order:
• ADC-1 (34-14-01)
• ADC-2 (34-14-01)

M1-0100-22-565

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 7)

EFFECTIVITY: ALL

001B

26 BOTH ATS FAIL LIGHTS ON (ATS DISC IF ENGAGED). BOTH SPEED FLAGS IN-VIEW

SPEED cont cmptr power supply fault (Speed cont cmptr FIM) → Replace speed cont cmptr (22-31-07)

27 ALL ATS, PITCH TRIM, MACH TRIM, MACH FEEL FAIL LIGHTS COME ON. (IF ENGAGED, ATS BAT HANDLE REMAINS ENGAGED)

Loss of trim aug cmptr power valid (Trim aug cmptr FIM) → Replace trim aug cmptr (22-18-01)

28 BOTH ATS FAIL LIGHTS ON

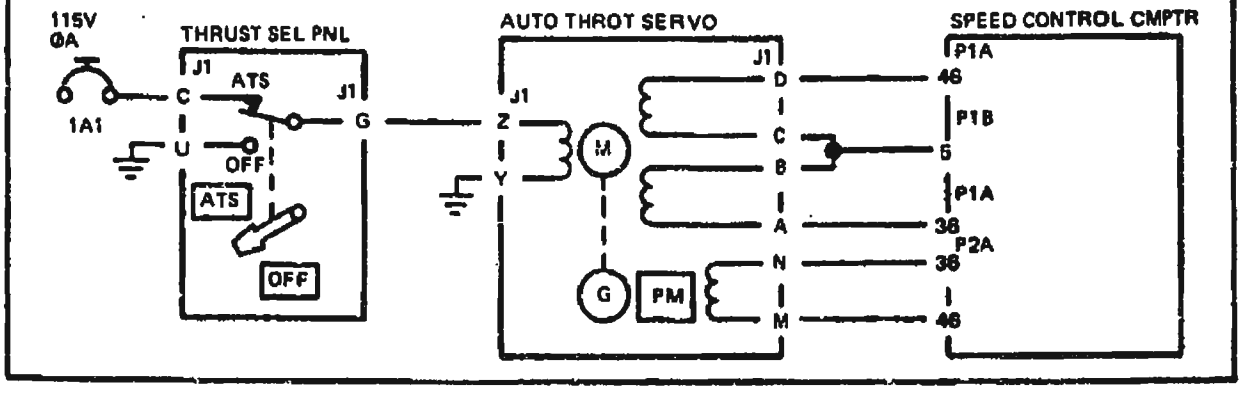
Long. accel not installed or cable disconnected → Install long. accel or connect cable

29 ATS DISC (MESSAGE AND RAT HANDLE DROPS). NO OTHER FAULTS

On FCES cmptr: chk auto tht servo FIM

- Yel → Replace auto throttle servo (22-31-01). Re-chk for auto tht servo FIM
  - Blk → Sys normal
  - Yel → Chk ckt #1
    - Ckt #1 chk OK → Replace speed cont cmptr (22-31-07)
    - Thrust sel pnl has open/short ckt → Replace thrust sel pnl (22-31-03)
    - A/C wiring fault → Repair wiring

CKT #1 AUTO THROT SERVO (REF. 22-31-00, SCHEM 1, 2)

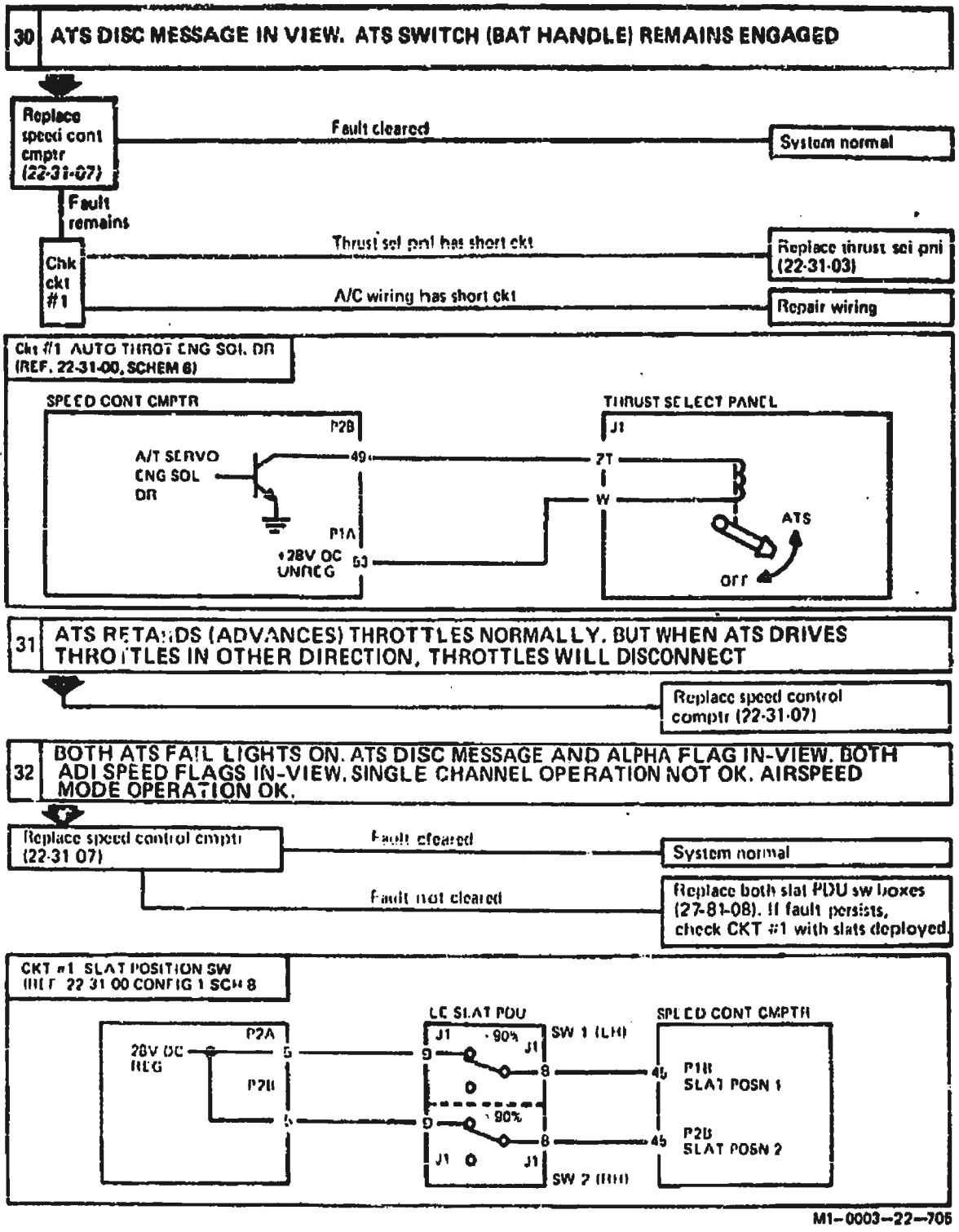


M1-0002-22-566

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 8)

EFFECTIVITY: ALL

001B

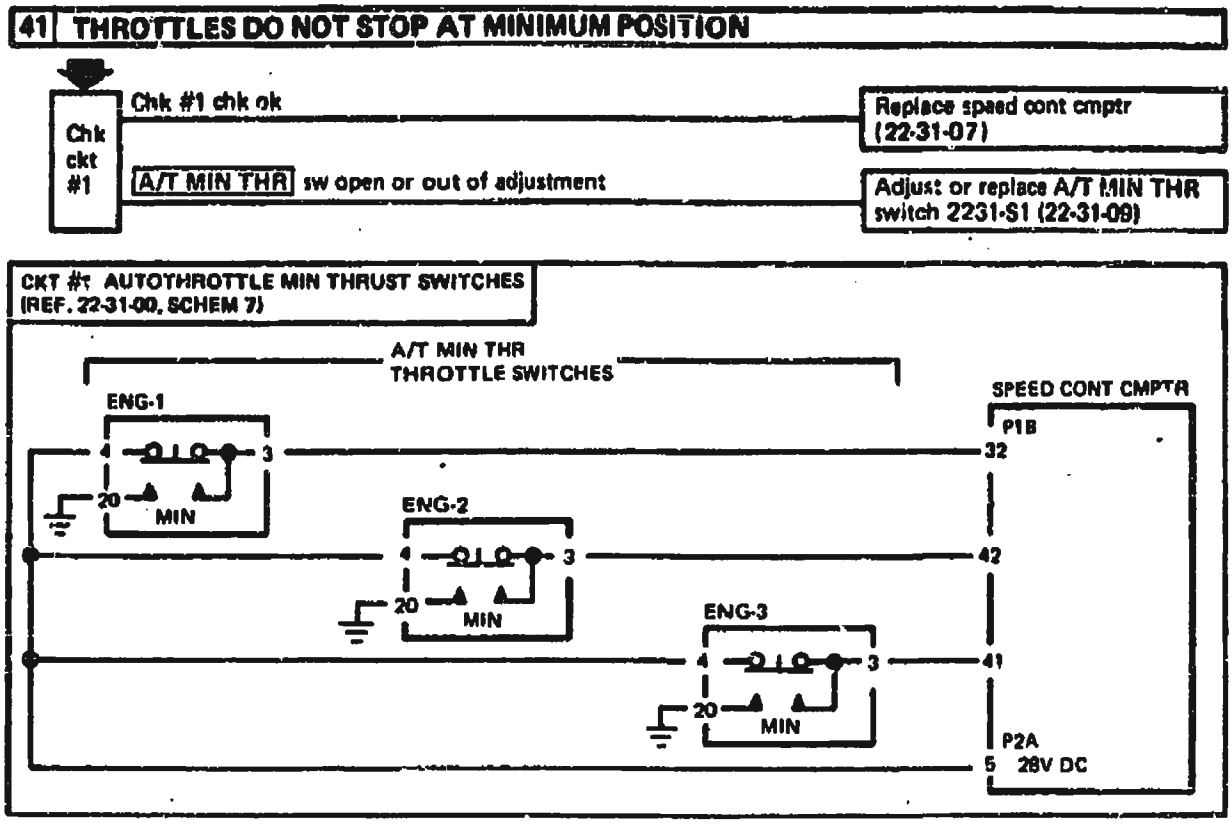


M1-0003-22-705

R ATS DISC/Dual FAIL Lights Faults
R Figure 105 (Sheet 9)

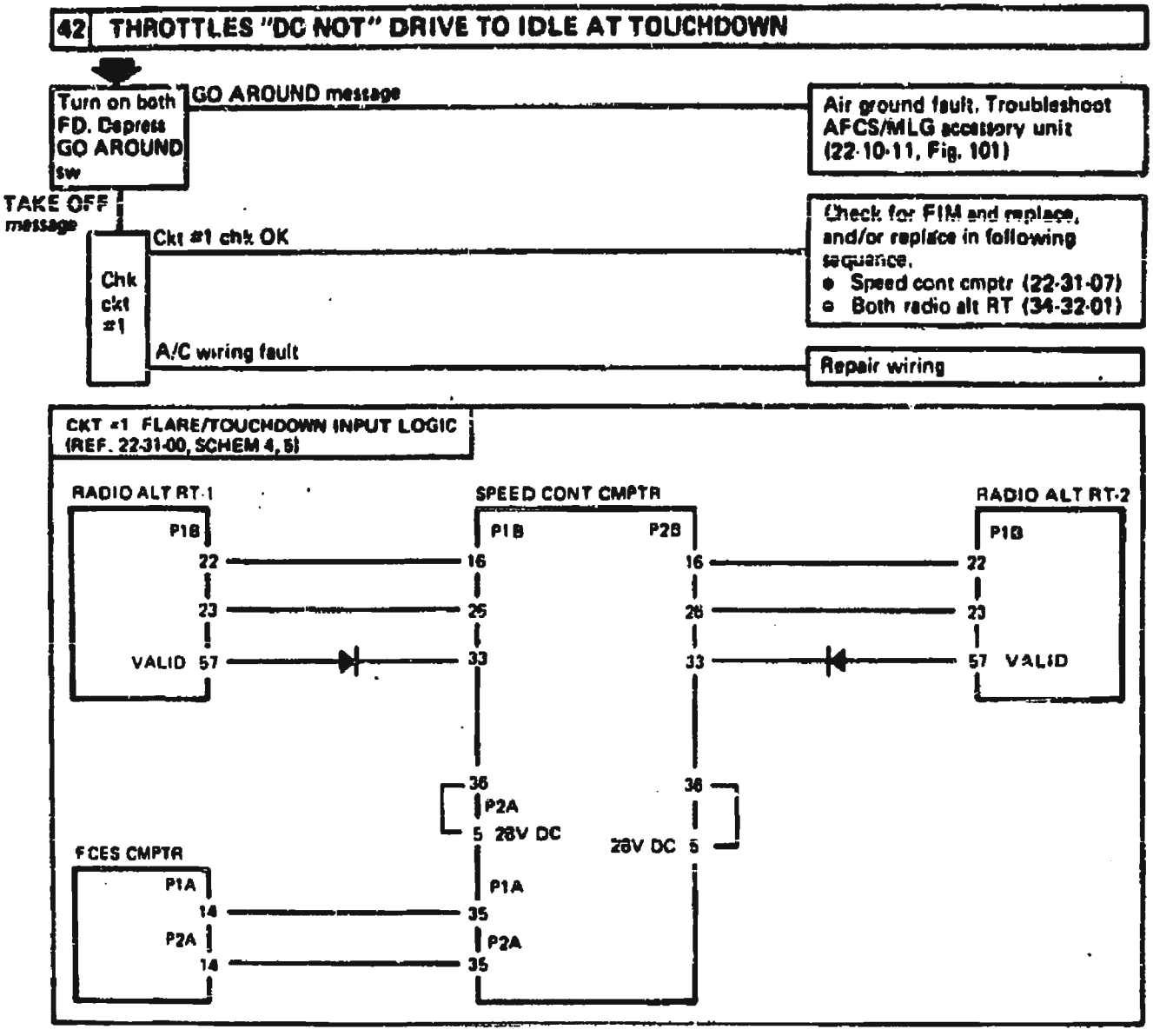
EFFECTIVITY: ALL

001B



M1-0002-22-568

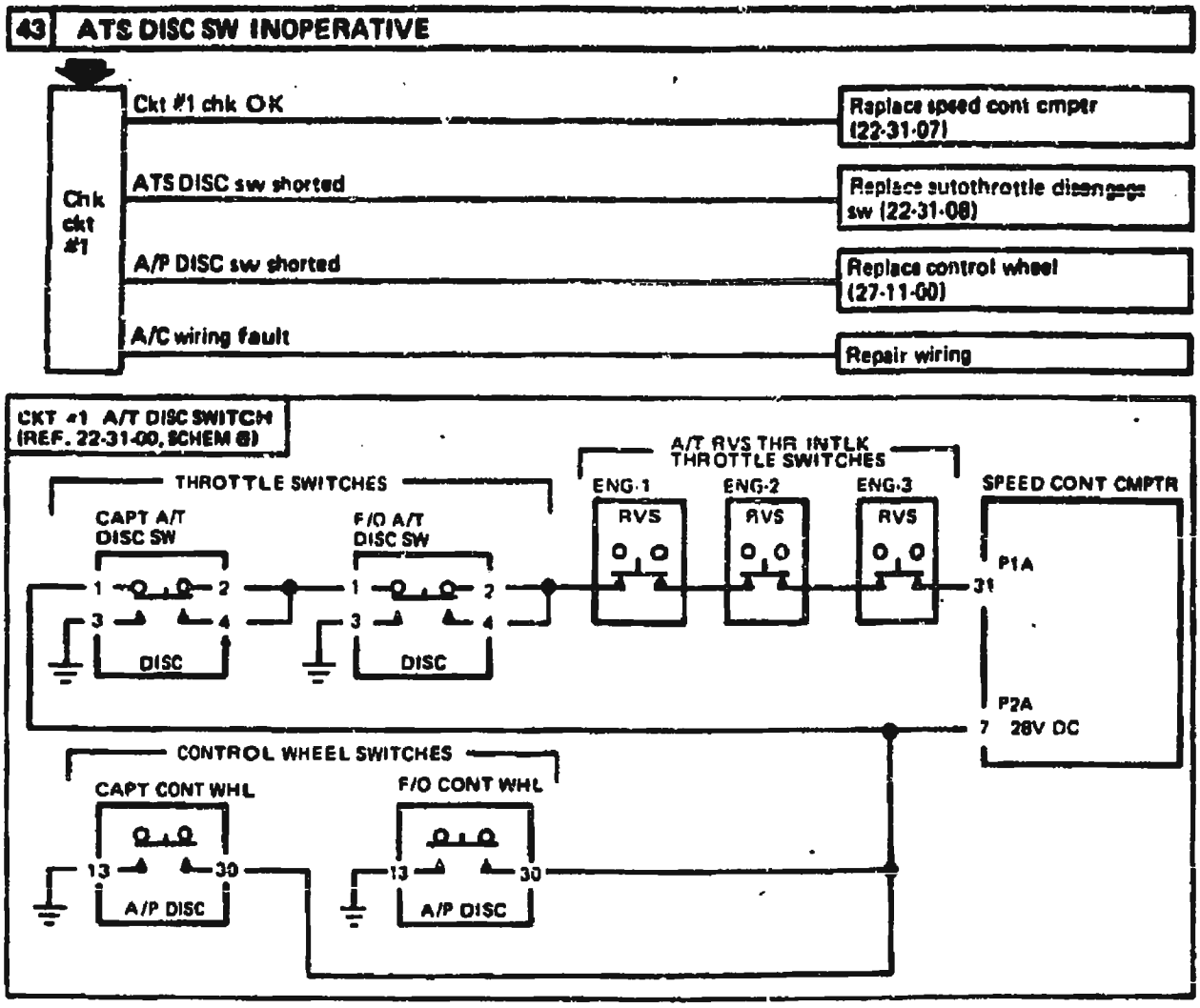
R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 1)



M1-0301-22-570

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 2)

EFFECTIVITY: ALL

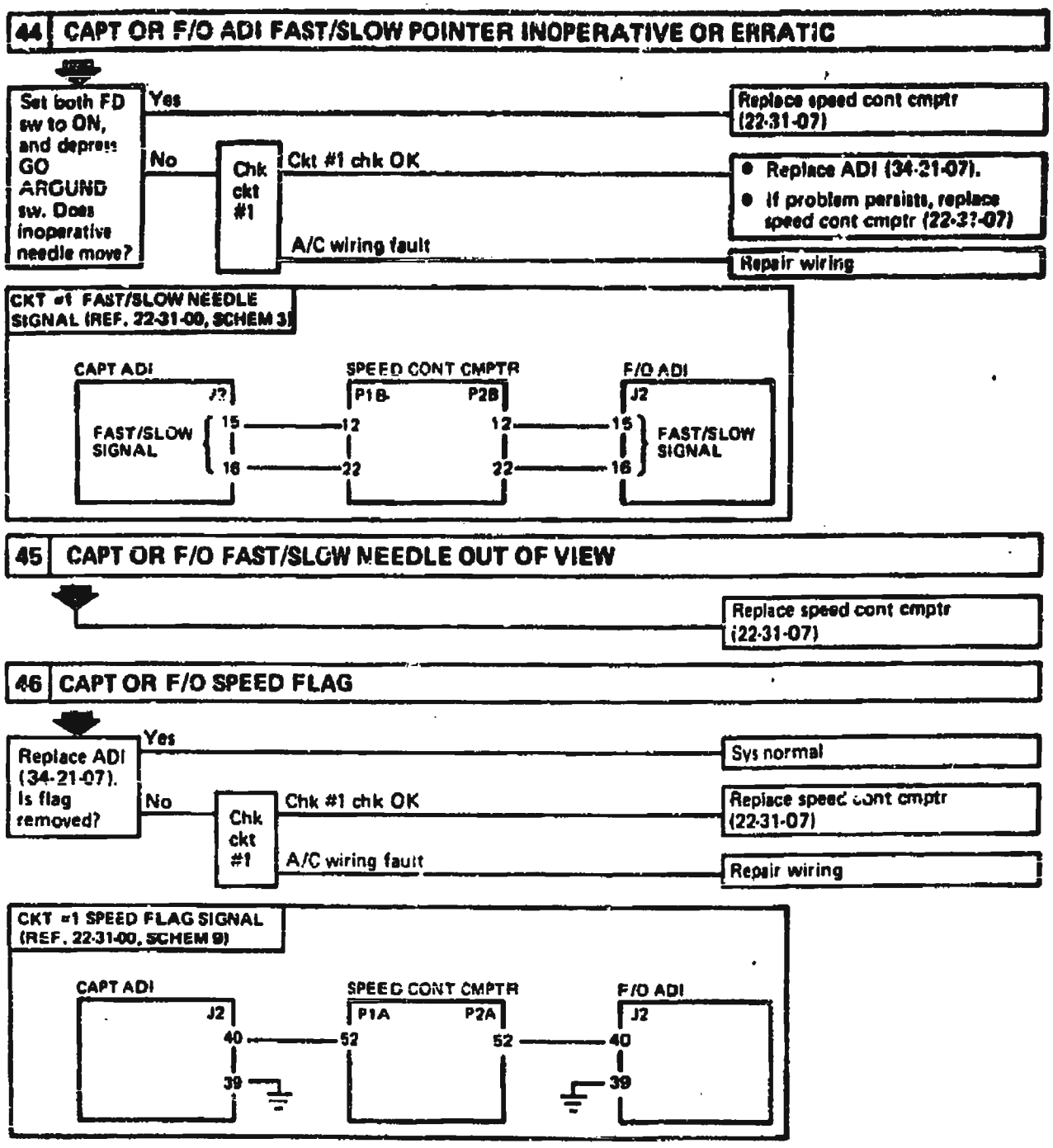


M1-0001-22-572

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 3)

EFFECTIVITY: ALL

001B

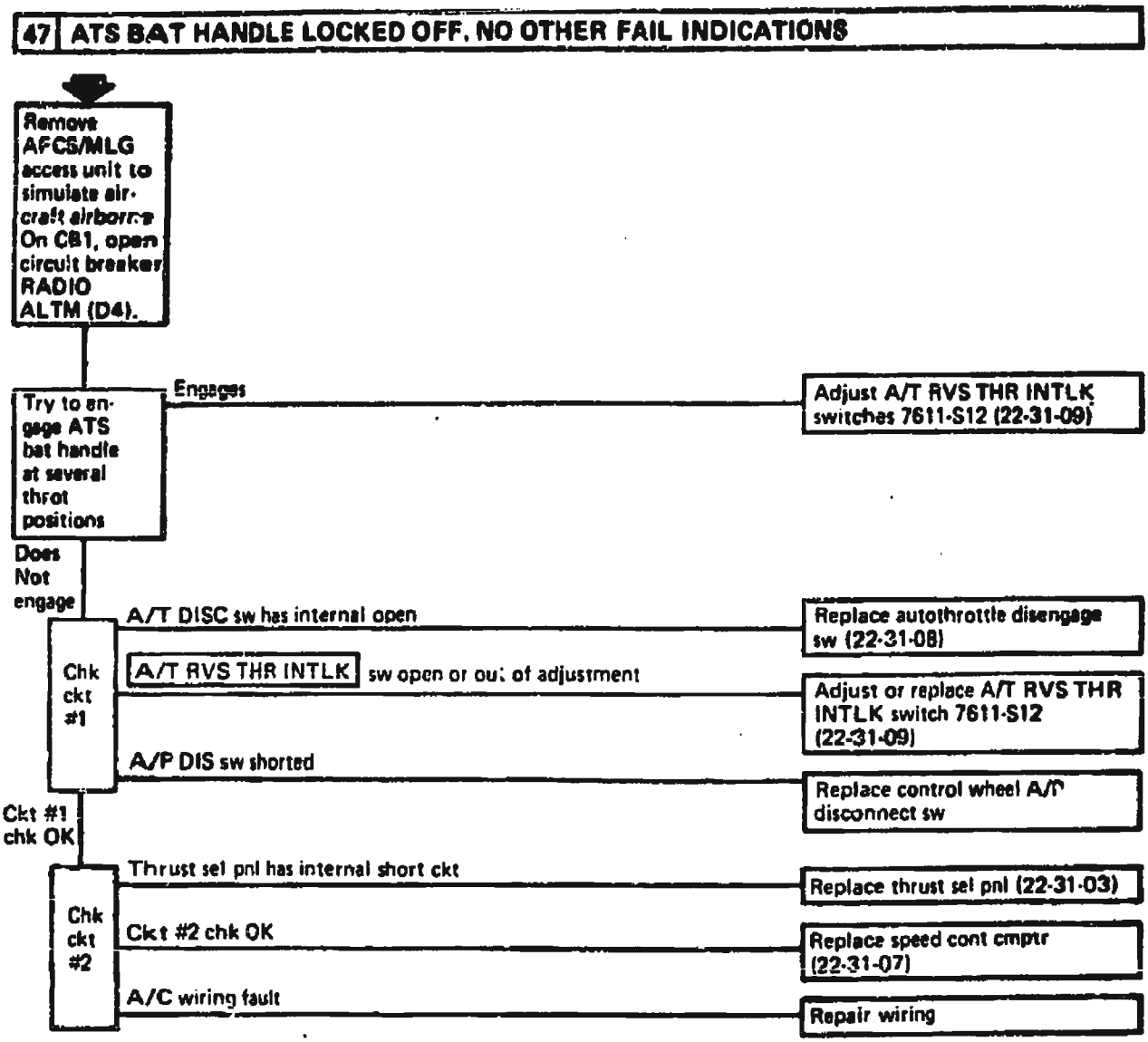


R
R

Other Autothrottle/Speed System Faults
Figure 106 (Sheet 4)

EFFECTIVITY: ALL

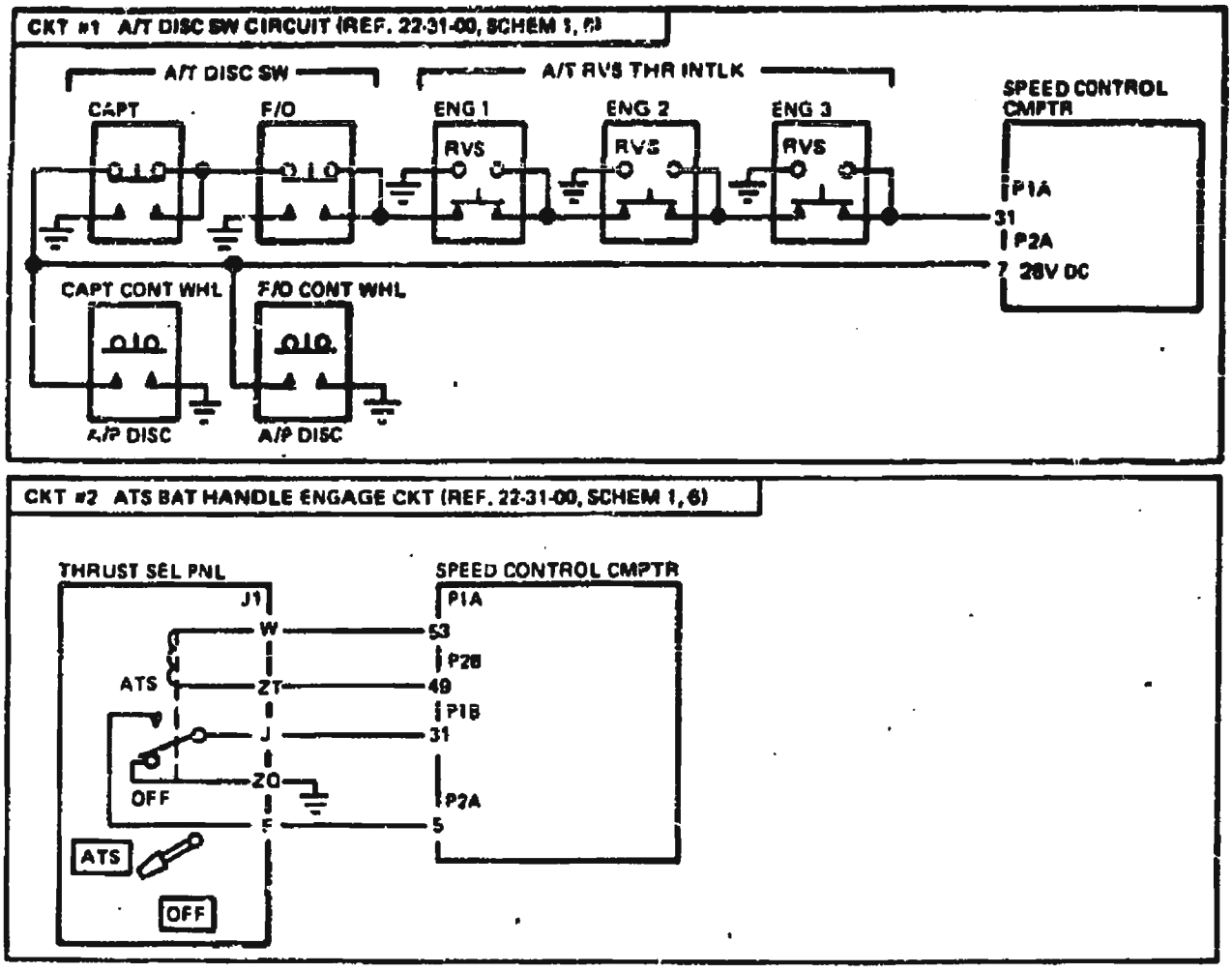
001B


47 ATS BAT HANDLE LOCKED OFF. NO OTHER FAIL INDICATIONS
Remove AFCS/MLG access unit to simulate aircraft airborne. On CB1, open circuit breaker RADIO ALTM (D4).
Try to engage ATS bat handle at several throt positions
Engages
Adjust A/T RVS THR INTLK switches 7611-S12 (22-31-09)
Does Not engage
Chk ckt #1
A/T DISC sw has internal open
Replace autothrottle disengage sw (22-31-08)
A/T RVS THR INTLK sw open or out of adjustment
Adjust or replace A/T RVS THR INTLK switch 7611-S12 (22-31-09)
A/P DIS sw shorted
Replace control wheel A/P disconnect sw
Ckt #1 chk OK
Chk ckt #2
Thrust sel pnl has internal short ckt
Replace thrust sel pnl (22-31-03)
Ckt #2 chk OK
Replace speed cont cmptr (22-31-07)
A/C wiring fault
Repair wiring

M1-0002-22-575

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 5)

47 CONTINUED

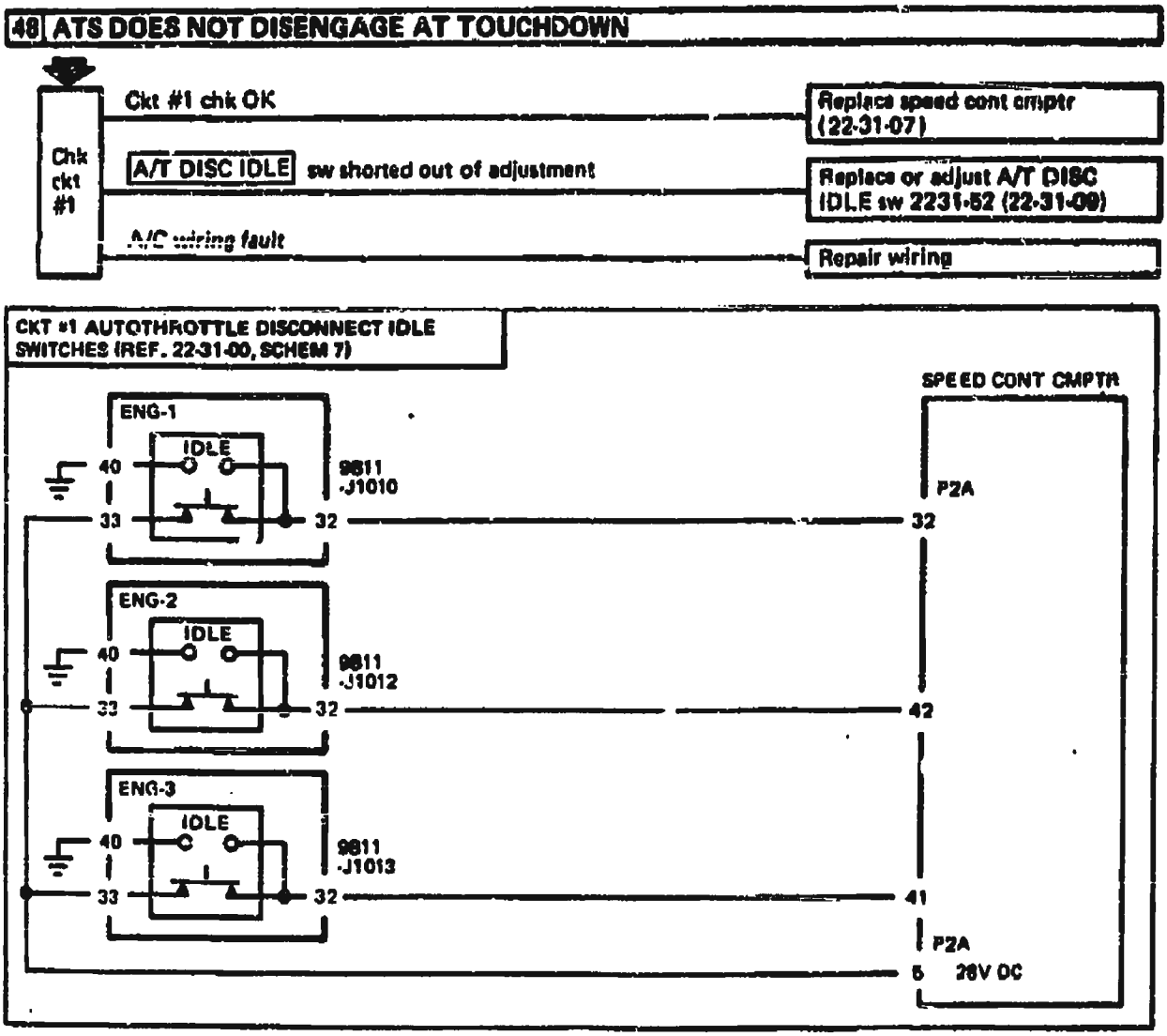


M1-0002-22-677

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 6)

EFFECTIVITY: ALL

001B

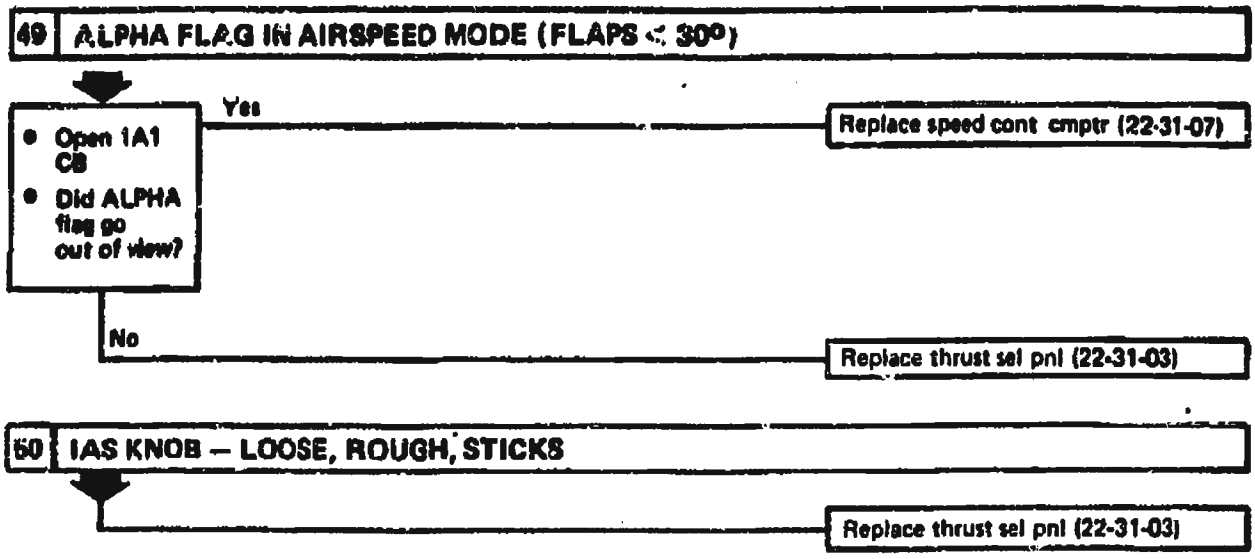


M1-0002-22-878

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 7)

EFFECTIVITY: ALL

001B

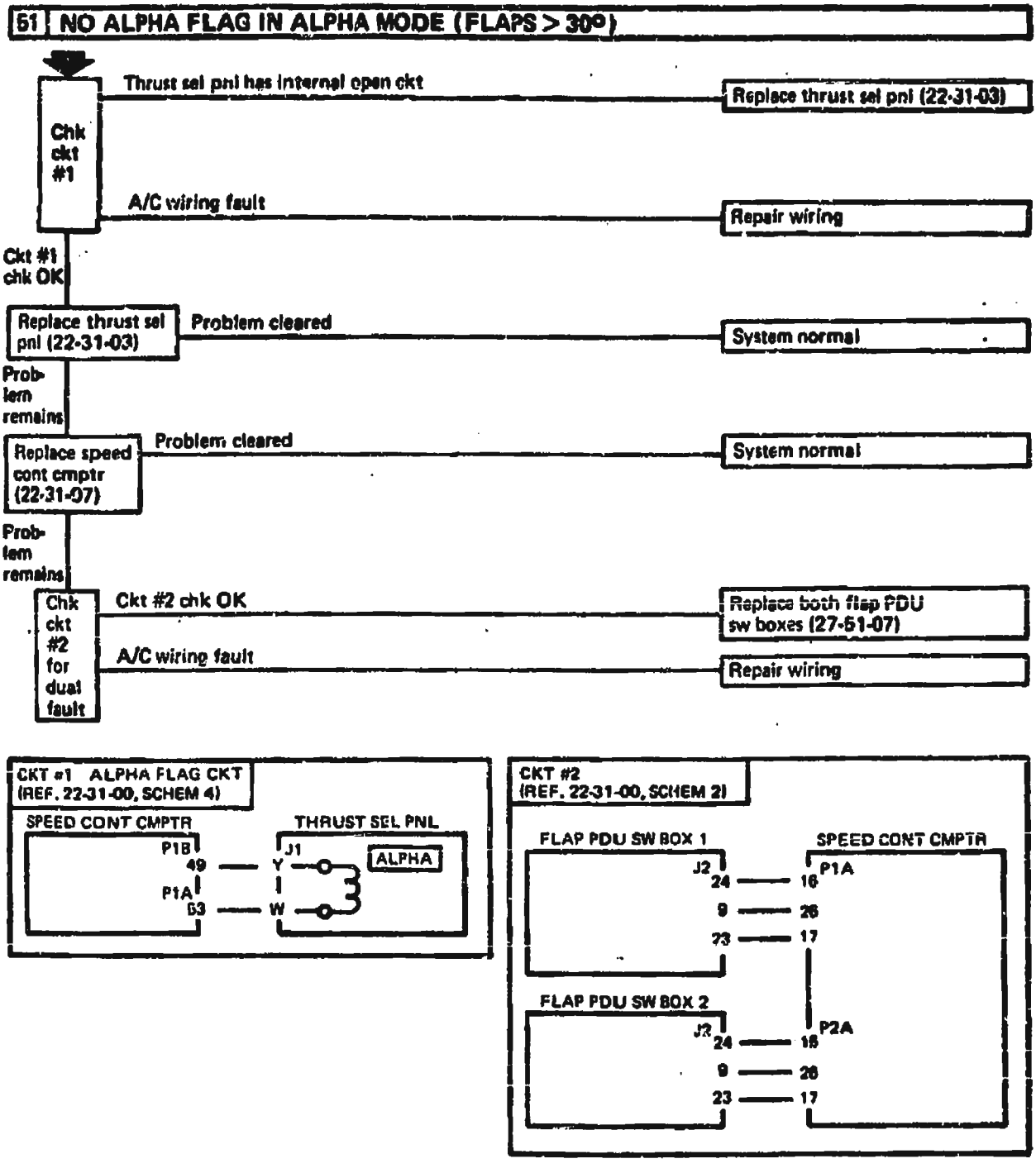

49 ALPHA FLAG IN AIRSPEED MODE (FLAPS < 30°)
• Open 1A1 CB
• Did ALPHA flag go out of view?
Yes
Replace speed cont cmptr (22-31-07)
No
Replace thrust sel pnl (22-31-03)
50 IAS KNOB — LOOSE, ROUGH, STICKS
Replace thrust sel pnl (22-31-03)

MI-0101-22-879

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 8)

EFFECTIVITY: ALL

001B



M1-0003-22-580

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 9)

EFFECTIVITY: ALL

52 SPEED TOO HIGH IN ALPHA MODE. SPEED V_{REF} +10 OR +20 (SHOULD BE V_{REF} +2 TO +5). NO OTHER COCKPIT INDICATIONS.

→ Replace speed cont cmptr (22-31-07).

NOTE

- Aircraft always flies fast
- Alpha mode design +2 to +5 knots fly fast
- Both sides OR'ed for 6 or 16 knot gust compensation

53 THROTTLES WILL NOT DRIVE TOGETHER (THROTTLE LAGGING)

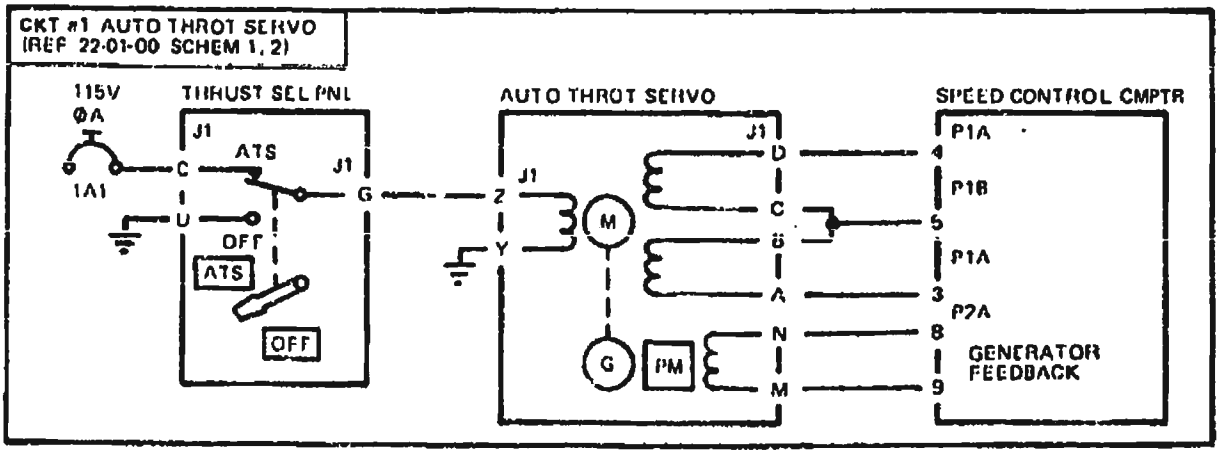
→ Lubricate fuel flow regulator (FFR) air throttle value (73-21-01). If fault persists, check throttle lever fault isolation (76-11-00).

54 THROTTLES DRIVE ABRUPTLY, ERRATIC OR HARDOVER

Is either single channel operation OK?

YES → Replace speed control computer.

NO → Replace authrottle servo (22 31-00). If problem persists, check CKT #1, especially gen feedback lines.



M1-0003-22-740

R Other Autothrottle/Speed System Faults
R Figure 106 (Sheet 10)

R B. System Oriented Fault Isolation

R Table 102 contains the speed control system fault isolation.

R The fault isolation procedure (Ref. Table 102) consists of a
R test procedure, normal observations, faults and corrective
R action. The test procedure and normal operations are used
R to verify the operational status of the system. When a
R fault occurs during the test, perform corrective actions
R adjacent to fault indication.

R If trouble shooting procedures outlined in this section do
R not isolate the problem, consult the wiring diagram manual
R and use the signal intercept cables (G/ITEL No. 22-00-19)
R for further analysis and isolation of the problem. The
R signal intercept cable (T-cable) permits monitoring of the
R speed control computer input/output functions with the
R system fully operational.

R Speed Control Fault Isolation
R Table 102

SET UP	ACTION	CHECK
1.	Turn on electrical power (Ref. 24-00-00).	
2.	.....	Avionics cooling is on (Ref. 21-00-00).
3.	.....	On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed: AUTO THROT SERVO (A1) SPEED CONT (A2) (A20)
4.	.....	On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed: AFCS WARNING CAPT (K18) AFCS WARNING F/O (K19)
5.	.....	On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that FLT CONT ALT ALERT (G9) circuit breaker is closed.
6.	In FESC, remove AFCS/MLG accessory unit from rack.	
7.	On FCES panel, depress STALL WARN 1 and 2 switchlights to OFF.	

Speed Control Fault Isolation (Cont)
Table 102

SET UP	ACTION	CHECK
	WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:	
	LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.	
	TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.	
	THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.	
8.	Turn on hydraulic systems A, B, C and D (Ref. 29-11-00).	
9.	Set all throttle levers to idle forward thrust (aft).	
10.	Set flaps to less than 30 degrees.	
11.	On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.	

Speed Control Fault Isolation
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
PERFORM PRELIMINARY PROCEDURE		
A. AIRSPEED MODE TEST		
1. FCES panel • Depress ATS 1 and 2 to on.	ATS lights dark.	Test OK.
	Both ATS 1 and 2 FAIL.	Replace speed control computer (Ref. 22-31-07). Replace trim aug computer (Ref. 22-18-01).
	ATS 1 FAIL.	(a) APFDS engage panel, set FD sw A to on. (b) HEADING/PITCH MODE panel, depress MACH to on. • If FD flag on Capt ADI, replace ADC No. 1 (Ref. 34-14-01). • If no flag, depress MACH to off, and set FD sw A to OFF. (c) Depress Capt ATT source sw. • ATT flag on Capt ADI, replace vertical gyro No. 3 (Ref. 34-21-04). • No ATT flag, depress Capt ATT source sw. (d) FCES panel, depress STALL WARN 1 to on. • If STALL WARN 1 FAIL, replace left angle-of attack sensor (Ref. 22-31-06) or troubleshoot STALL WARN (Ref. 22-17-05). (Ref. 22-17-00). • If STALL WARN 1 OK, depress STALL WARN 1 to OFF.

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		(e) APFDS ENGAGE panel, set AP engage sw A to CWS. • If sw A can't be raised, replace normal accelerometer unit (Ref. 22-11-02) or troubleshoot autopilot (Ref. 22-10-33). • If OK, set sw A to OFF. (f) Disconnect plugs from longitudinal accel No. 1 and No. 2. Then connect No. 2 plug to accel No. 1, and No. 1 plug to accel No. 2. • If ATS 1 FAIL is removed, replace longitudinal accel unit (Ref. 22-31-05). • If ATS 1 still FAIL, connect plugs to original accel. (g) Replace speed control computer (Ref. 22-31-07).
	ATS 2 FAIL.	(a) APFDS ENGAGE panel, set FD sw B to on. (b) HEADING/PITCH MODE panel, depress MACH to on. • If FD flag on F/O ADI, replace ADC No. 2 (Ref. 34-14-01). • If no flag, depress MACH to off, and set FD sw B to OFF. (c) ATT flag on F/O ADI, replace vertical gyro No. 2 (Ref. 34-21-04).

R
R

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		(d) FCES panel, depress STALL WARN 2 to on. • If STALL WARN 2 FAIL, replace right angle-of-attack sensor (Ref. 22-31-06) or troubleshoot STALL WARN (Ref. 22-17-05). • If STALL WARN 2 OK, depress STALL WARN 2 to OFF. (e) APFDS ENGAGE panel, set ATP engage sw B to CWS. • If sw B can't be raised, replace normal accelerometer unit (Ref. 22-11-02) or troubleshoot autopilot (Ref. 22-10-35). • If OK, set sw B to OFF. (f) Disconnect plugs from longitudinal accel No. 1 and No. 2. Then connect No. 2 plug to accel No. 1, and No. 1 plug to accel No. 2. • If ATS 2 FAIL is removed, replace longitudinal accel unit (Ref. 22-31-05) • If ATS 2 still FAIL, connect plugs to original accel. (g) Replace speed control computer (Ref. 22-31-07).
2. Move all throttle levers between IDLE and MAX positions.	Throttle levers move smooth.	Test OK.

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	Friction of any lever excessive (Max 3-lb).	Check engine control system (Ref. 76-11-00, adjustment and test).
3. Set all throttle levers to mid-position.		No test.
4. Depress ATS 2 to OFF.		No test.

WARNING: DO NOT ROTATE ANGLE OF ATTACK PROBE UNLESS THE FOLLOWING WARNINGS ARE OBSERVED:

- PROBE HEATERS SHALL BE OFF.
- APPLICABLE ANGLE OF ATTACK CIRCUIT BREAKER SHALL BE OPEN.

  CB1 panel, L AOA (B5)

  CB2 panel, R AOA (F1)
- DO NOT USE GLOVES OR TOOLS.
- USE BARE HANDS.
- DO NOT COVER HOLES IN PROBE.
- HOLD SHAFT CLOSE TO FUSELAGE AS POSSIBLE AND DO NOT TOUCH HOLES.
- TURN PROBE SLOWLY.
- DO NOT ATTEMPT TO TURN PROBES BEYOND STOPS.

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
5. Adj AOA probes to fast position as follows: • CB1, open B5 CB. • CB2, open F1 CB. • Observing WARNING, position left and right probes until forward edges are full up. • CB1, close B5. • CB2, close F1.	THRUST panel. • ALPHA flag out of view.	No test.
	NOTE: AOA probes rotate as soon as B5 and F1 are closed. If ALPHA flag comes into view during following test, check AOA probes for deviation from fast position. Minor disturbances such as gusts of wind or servo imbalance may drive AOA probes from the required fast position. Reposition if required.	
6. THRUST panel • Set IAS to 310 knots, to 275 knots, and then to approx. 295 knots	Capt ADI FAST/SLOW ind. • FAST at 310 knots • SLOW at 275 knots • Centered at approx. 295 knots.	Test OK.
NOTE: 295 knots is a false null.	FAST/SLOW ind. inoperative.	Check system No. 2 (Steps 7 and 8).
7. Depress ATS 2 to on, and ATS 1 to OFF.		No test.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	8. THRUST panel • Set IAS to 310 knots, to 275 knots, and then to approx. 295 knots.	F/O ADI FAST/SLOW ind. • FAST at 310 knots • SLOW at 275 knots • Centered at approx. 295 knots.	Test OK.
R R R R R		FAST/SLOW ind. inoperative in tests 6 and 8.	Replace THRUST panel (Ref. 22-31-03). Replace speed control computer (Ref. 22-31-07).
R R R R R R R R		FAST/SLOW in. inoperative in test 6.	Replace Capt ADI (Ref. 34-21-07). Replace ADC No. 1 (Ref. 34-14-01). Replace THRUST panel (Ref. 22-31-03). Replace speed control computer (Ref. 22-31-07).
R R R R R R R R R		FAST/SLOW ind. inoperative in test 8.	Replace F/O ADI (Ref. 34-21-07). Replace ADC No. 2 (Ref. 34-14-01). Replace THRUST panel (Ref. 22-31-03). Replace speed control computer (Ref. 22-31-07).
	9. THRUST panel. • Set ATS sw to ATS (up), and adjust IAS to stop autothrottle movement (approx. 295 knots).	ATS sw remains up. Throttle levers centered. ALPHA flag out-of-view.	Test OK.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R R R		ATS sw will not move from OFF. ADI FAST/SLOW ind. biased out-of-view.	(a) Remove pitch computers No. 1 and 2 (Ref. 22-11-01). • If ATS sw engages, replace pitch computer No. 1 or No. 2. • If ATS sw does not engage, install pitch computers and go to Step (b).
R R R R R R R R R R R			(b) Replace speed control computer (Ref. 22-31-07). (c) Replace THRUST panel (Ref. 22-31-03). (d) Replace longitudinal accelerometers (Ref. 22-31-05). (e) Replace autothrottle servo (Ref. 22-31-01). (f) Shorted A/T DISC sw circuit. Check wiring (Ref. 22-31-00, SCHEM 6).
R R R R		ATS sw drops to OFF.	Replace speed control computer (Ref. 22-31-07). Replace auto throttle servo (Ref. 22-31-01).
	10. THRUST panel • Set IAS to 310 knots. • Check that throttles can be manually overridden.	Throttles retard to minimum position and stop. F/O ADI ind. FAST.	Test OK.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		NOTE: Minimum throttle position is rear of throttle levers at 2(±1) on 0-10 scale adjacent to levers.	
		Throttles do not move, ATS switch drops to OFF.	Replace speed control computer (Ref. 22-31-07). Replace auto throttle servo (Ref. 22-31-01).
R R		Throttles do not stop within minimum position.	Adjust auto throttle minimum thrust switches (Ref. 76-11-06).
	11. On left throttle lever, depress Capt ATS disengage sw.	THRUST panel. • ATS sw drops to OFF. AFCS WARNING ind. • Flashing ALERT. • ATS DISC message.	Test OK.
		No disconnect.	Replace speed control computer (Ref. 22-31-07). Replace Capt ATS disengage sw (Ref. 22-31-08).
R R R		One AFCS WARNING ind. inoperative.	Perform warning annunciation test (Ref. 22-02-01). Replace AFCS WARNING ind. No. 1 (Capt) or No. 2 (F/O) (Ref. 22-10-06).
	12. Depress Capt ATS disengage sw.	AFCS WARNING ind. • ALERT light goes out. • ATS DISC message is removed	Test OK.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
		AFCS WARNING message not removed.	Replace speed control computer (Ref. 22-31-07).
	13. THRUST panel • Set ATS sw to ATS. • Set IAS to 275 knots • Check that throttles can be manually overridden.	Throttles move to maximum position and stop. F/O ADI ind. SLOW.	Test OK.
R R		Throttles drive full forward and hunt.	Adjust auto throttle maximum thrust switches (Ref. 76-11-06).
	14. On right throttle lever, depress F/O ATS disengage sw.	THRUST panel. • ATS sw drops to OFF AFCS WARNING ind. • Flashing ALERT. • ATS DISC message.	Test OK.
		No disconnect	Replace F/O ATS disengage sw (Ref. 22-31-08).
	15. Depress F/O ATS disengage sw.	AFCS WARNING ind. • ALERT light goes out. • ATS DISC message is removed.	No test.
	16. Set IAS to approx. 295 knots.	F/O ADI FAST/SLOW ind. centered.	No test.
	17. Set all throttle-levers to mid-position.		No test.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	18. Depress ATS 2 to OFF, and 1 to ON.		No test.
	19. Galley • With cables connected, disconnect longitudinal accelerometer from mcunt. • Tilt 90 deg nose down from normal.	Capt ADI • SLOW ind.	Test OK.
R R		No FAST/SLOW indication.	Replace longitudinal accelerometer unit (Ref. 22-31-05). Replace speed control computer (Ref. 22-31-07).
	20. Depress ATS 2 to ON, and ATS 1 to OFF.		No test.
	21. Tilt longitudinal accelerometer 90 deg nose up from normal.	F/O ADI • FAST ind.	Test OK.
R R		No FAST/SLOW indication	Replace longitudinal accelerometer unit (Ref. 22-31-05). Replace speed control computer (Ref. 22-31-07).
	22. Galley • Install longitudinal accelerometer unit.		No test.
	23. Depress ATS 1 to on.		No test.

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	B. STALL MARGIN MODE TEST	
1. FCES panel • Ensure both ATS 1 and 2 are on. • Depress DLC/ AUTO SPLR 1 and 2 to OFF.		No test.

WARNING: DO NOT ROTATE ANGLE OF ATTACK PROBE UNLESS THE FOLLOWING WARNINGS ARE OBSERVED:

- PROBE HEATERS SHALL BE OFF.
- APPLICABLE ANGLE OF ATTACK CIRCUIT BREAKER SHALL BE OPEN.

  CB1 panel, L AOA (B5)

  CB2 panel, R AOA (F1)
- DO NOT USE GLOVES OR TOOLS.
- USE BARE HANDS.
- DO NOT COVER HOLES IN PROBE.
- HOLD SHAFT CLOSE TO FUSELAGE AS POSSIBLE AND DO NOT TOUCH HOLES.
- TURN PROBE SLOWLY.
- DO NOT ATTEMPT TO TURN PROBES BEYOND STOPS.

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
2. If alpha flag is in view on THRUST panel, R adj AOA probes to fast position as follows: • CB1, open B5 CB. • CB2, open F1 CB. • Observing WARNING, position left and right probes until forward edges are full up. • CB1, close B5. • CB2, close F1.	NOTE: AOA probes rotate as soon as B5 and F1 are closed.	No test.
3. Set flaps to greater than 30 deg.	THRUST panel. • ALPHA flag. Both ADI FAST/SLOW ind. fast.	Test OK.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R		No ALPHA flag.	Replace speed control computer (Ref. 22-31-07). Replace THRUST panel (Ref. 22-31-03). Depress ATS 2 to OFF • If ALPHA flag, replace flap PDU limit switch box No. 2 (Ref. 27-51-12). • If no flag, depress ATS 2 to on. Depress ATS 1 to OFF. • If ALPHA flag, replace flap PDU limit switch box unit No. 1 (Ref. 27-51-12).
	4. Manually set speed brakes to DLC neutral (7 degrees).	Spoiler handle in middle white area marked DLC.	No test.
	5. Set throttle levers to less than takeoff.	Rear of throttle levers at less than 5-1/2 on scale adjacent to throttles.	No test.
	6. Depress ATS 2 to OFF.	Capt ADI • FAST ind.	Test OK.
		No FAST movement.	Replace speed control computer (Ref. 22-31-07). Replace left angle of attack sensor (Ref. 22-31-06).
	7. Depress ATS 1 to OFF and ATS 2 to on.	F/O ADI • FAST ind.	Test OK.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
R R R R R		No FAST movement.	Replace speed control computer (Ref. 22-31-07). Replace right angle-of-attack sensor (Ref. 22-31-06).
	8. Depress ATS 1 to on.		No test.
	9. Adjust AOA probes to center position as follows: • CB1, open B5 CB. • CB2, open F1 CB. • Observing WARNING, position left and right probes to center of travel. • CB1, close B5. • CB2, close F1.	Both ADI • FAST/SLOW ind. approx. centered. NOTE: AOA probes rotate as soon as B5 and F1 are closed.	No test.
	10. Manually set speedbrake lever to upper limits, to lower limits, and then to center of DLC range.	Both ADI. • Upper limit - FAST. • Lower Limit - SLOW. • Center - FAST/SLOW approx center.	Test OK.
R R R R		No FAST/SLOW movement on both ADIs.	Replace speed control computer (Ref. 22-31-07). Replace FCES computer (Ref. 22-17-01).

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
RRRRRR		No FAST/SLOW movement on one ADI.	Replace speed control computer (Ref. 22-31-07). Replace FCES computer (Ref. 22-17-01). Replace DLC servo (Ref. 27-61-06).
	11. Galley • With cables connected, disconnect normal accelerometer unit. • Tilt 90 deg nose down. • Install normal accelerometer unit.	Both ADI • FAST/SLOW ind. moves toward FAST when tilted.	Test OK.
RRRRR		No FAST/SLOW movement on one or both ADIs.	Replace speed control computer (Ref. 22-31-07). Replace normal accelerometer unit (Ref. 22-11-02).
	12. Set flaps to less than 30 degrees.		
	C. AUTOTHROTTLE/PITCH MODE INTERLOCK TEST.		
	1. THRUST panel • Set ATS sw to ATS.	THRUST panel. • ATS sw remains up. Throttle levers may move.	No test.
	2. APFDS ENGAGE panel. • Set FD A to ON.		No test.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	3. HEADING/PITCH MODE panel. • Depress MACH to on, then off.	THRUST panel. • ATS sw drops to OFF. AFCS WARNING ind. • Flashing ALERT. • ATS DISC messages	Test OK.
R R R R		No Disconnect.	Set FD B to ON and repeat Step C. • If disconnects, replace pitch computer No. 1 (Ref. 22-11-01). • No disconnect, replace speed control computer (Ref. 22-31-07).
	4. Left throttle lever. • Depress ATS disengage sw.	AFCS WARNING ind. • ALERT lights go out. • ATS DISC messages are removed.	No test.
	5. Set ATS sw to ATS.	ATS sw remains up.	No test.
	6. HEADING/PITCH MODE panel. • Depress IAS to on, then off.	THRUST panel. • ATS sw drops to OFF. AFCS WARNING ind. • Flashing ALERT. • ATS DISC message.	Test OK.
R		No disconnect.	Replace pitch computer No. 1 (Ref. 22-11-01).
	7. Set ATS sw to ATS.		No test.
	8. APFDS ENGAGE panel. • Set AP engage sw to CWS • Depress TURB to on, then off.	THRUST panel. • ATS sw drops to OFF. AFCS WARNING ind. • Flashing ALERT. • ATS DISC message.	Test OK.
		No disconnect.	Replace pitch computer No. 1.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	9. Set ATS sw to ATS.	ATS sw remains up.	No test.
	10. APFDS ENGAGE panel. • Set AP engage sw A to OFF and sw B to CWS. • Set FD A to OFF, and FD B to ON.		No test.
	11. APFDS ENGAGE panel. • Depress TURB to on, then OFF.	THRUST panel. • ATS sw drops to OFF. AFCS WARNING ind. • Flashing ALERT. • ATS DISC message.	Test OK.
R R R R		No disconnect.	Replace pitch computer No. 2 (Ref. 22-11-01). Replace speed control computer (Ref. 22-31-07).
	12. Set ATS sw to ATS.	ATS sw remains up.	No test.
	13. Either control wheel. • Depress AP DISC sw to disengage AP. • Depress AP DISC sw again to clear AP DISC messages.	AP engage sw B drops to OFF.	No test.
	14. HEADING/PITCH MODE panel. • Depress MACH to on, then off.	THRUST panel. • ATS sw drops to OFF. AFCS WARNING ind. • Flashing ALERT. • ATS DISC messages.	Test OK.
R		No disconnect.	Replace pitch computer No. 2 (Ref. 22-11-01).

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	15. Set ATS sw to ATS.	ATS sw remains up.	No test.
	16. HEADING/PITCH MODE panel. • Depress IAS to on, then off.	THRUST panel. • ATS sw drops to OFF. AFCS WARNING ind. • Flashing ALERT. • ATS DISC message.	Test OK.
R		No disconnect.	Replace pitch computer No. 2 (Ref. 22-11-01).
	17. Set ATS sw to ATS.	ATS sw remains up.	No test.
	18. Either control wheel. • Depress TO/GA sw.	THRUST panel. • ATS sw drops to OFF. AFCS MODES ann. • GO ARND messages.	Test OK.
R R R R R		No disconnect.	Set FD A to ON, and repeat Step 18. • If disconnect, replace pitch computer No. 2 (Ref. 22-11-01). • No disconnect, replace speed control computer (Ref. 22-31-07).
	19. APFDS ENGAGE panel. • Set FD B to OFF, and FD A to ON.		No test.
	20. Set ATS sw to ATS.	ATS sw remains up.	No test.
	21. Either control wheel. • Depress TO/GA sw.	THRUST panel. • ATS sw drops to OFF. AFCS MODES ann. • GO ARND messages.	Test OK.

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	No disconnect.	Replace pitch computer No. 1 (Ref. 22-11-01). Replace speed control computer (Ref. 22-31-07).
22. APFDS ENGAGE panel. • Set FD A to OFF.		No test.
D. GO-AROUND MODE TEST.		
1. Set flaps to zero deg.		No test.
2. Ensure that AFCS/MLG accessory unit is removed.		No test.

WARNING: DO NOT ROTATE ANGLE OF ATTACK PROBE UNLESS THE FOLLOWING WARNINGS ARE OBSERVED:

- PROBE HEATERS SHALL BE OFF.
- APPLICABLE ANGLE OF ATTACK CIRCUIT BREAKER SHALL BE OPEN.

  CB1 panel, L AOA (B5)

  CB2 panel, R AOA (F1)

- DO NOT USE GLOVES OR TOOLS.
- USE BARE HANDS.
- DO NOT COVER HOLES IN PROBE.
- HOLD SHAFT CLOSE TO FUSELAGE AS POSSIBLE AND DO NOT TOUCH HOLES.
- TURN PROBE SLOWLY.
- DO NOT ATTEMPT TO TURN PROBES BEYOND STOPS.

Speed Control Fault Isolation (Cont)
Table 102

	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	3. Adj. AOA probes to fast position as follows: • CB1, open B5 CB. • CB2, open F1 CB. • Observing WARNING, position left and right probes until forward edges are full up. • CB1, close B5. • CB2, close F1.	NOTE: AOA probes rotate as soon as B5 and F1 are closed.	No test.
	4. APFDS ENGAGE panel. • Set FD A to ON and B to OFF.		No test.
	5. Capt control wheel. • Depress TO/GA sw.	THRUST panel. • ALPHA flag. Both ann. • GO ARND displayed. Capt ADI. • FAST/SLOW ind approx fast. • CMD bars approx centered.	Test OK.
R R R		No ALPHA flag, no GO ARND displayed, no ADI ind.	Replace pitch computer No. 1 (Ref. 22-11-01). Troubleshoot Go-Around Mode. (Ref. 22-12-39).

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	GO ARND displayed, but no ALPHA flag or ADI ind.	Replace speed control computer (Ref. 22-31-07).
6. Set FD A to OFF, and B to ON.	GO ARND mode disengaged.	No test.
7. F/O control wheel. • Depress TO/GA sw.	THRUST panel. • ALPHA flag Both ann. • GO ARND displayed F/O ADI. • FAST/SLOW ind. fast. • CMD bars approx. centered.	Test OK.
R	No ALPHA flag, no GO ARND displayed, no ADI ind.	Replace pitch computer No. 2 (Ref. 22-11-01). Troubleshoot Go Around Mode (Ref. 22-12-39).
	GO ARND displayed, but no ALPHA flag or ADI ind.	Replace speed control computer (Ref. 22-31-07).
8. Set FD B to OFF.	GO ARND mode disengaged.	No test.
9. FCES panel. • Set ATS 2 to OFF.		No test.

NOTE: Ensure electr pwr on aircraft for 3-min and G6, G24, E24 on CB1 closed prior to Step 10.

Speed Control Fault Isolation (Cont)
Table 102

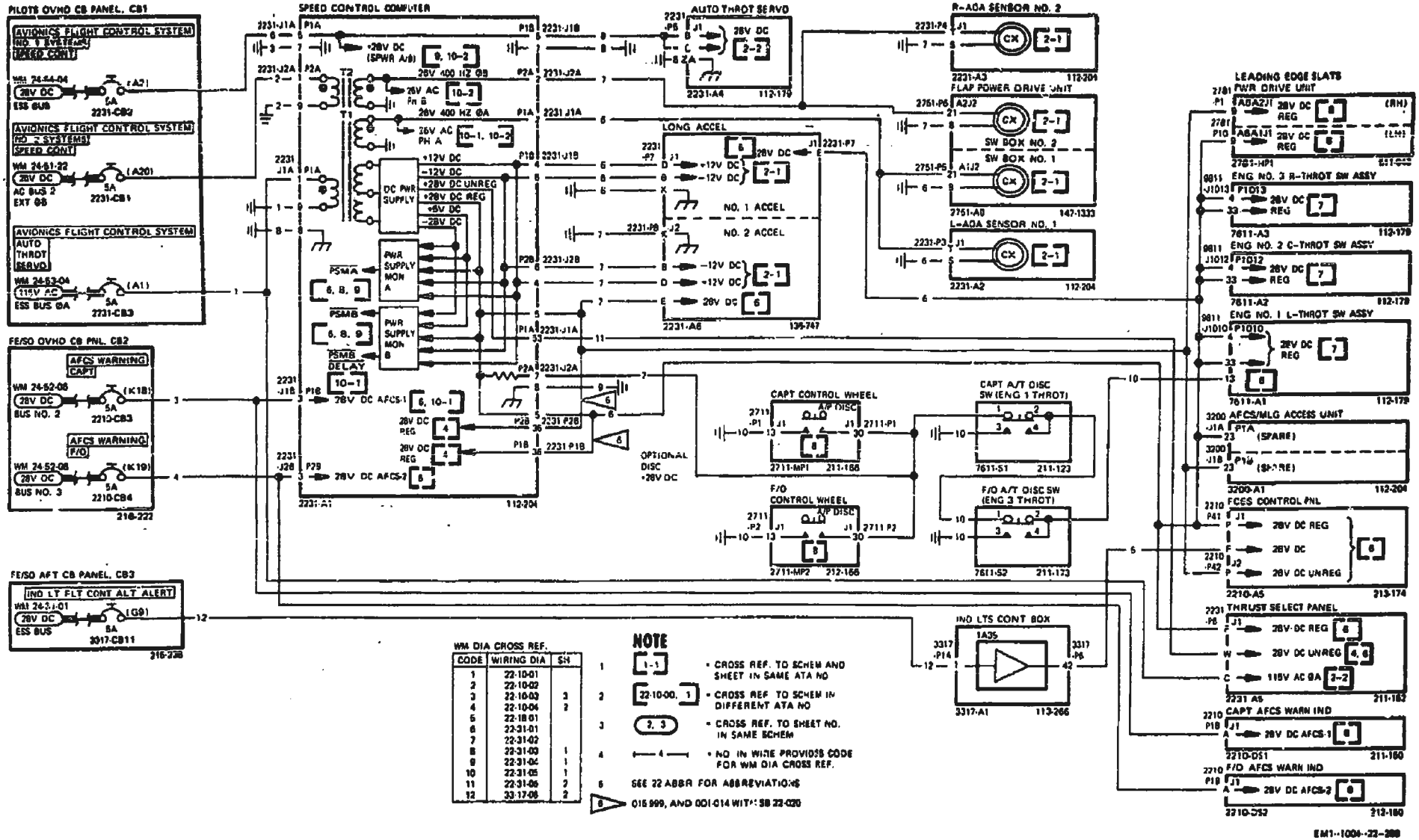
PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
10. FESC forward rack. • Cables connected, remove vertical gyro No. 3 and place in 10 deg nose down att. • Install vertical gyro No. 3 in mount.	Capt ADI. • SLOW/FAST ind. moves in FAST direction when gyro is nose down.	Test OK.
	No SLOW/FAST ind.	R Replace vertical gyro No. 3 (Ref. 34-21-04). R Replace speed control computer (Ref. R 22-31-07).
11. Set ATS 2 to on. and ATS 1 to OFF.		No test.
12. FESC forward rack• Cables connected, remove vertical gyro No. 2 and place in 10 deg nose down att• Install vertical gyro No. 2 in mount. • SLOW/FAST ind. moves in FAST direction when gyro is nose down.		Test OK.
	No SLOW/FAST ind.	R Replace vertical gyro No. 2 (Ref. 34-21-04). R Replace speed control computer (Ref. R 22-31-07).

Speed Control Fault Isolation (Cont)
Table 102

PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
13. Set ATS 1 to on.		No test.
	E. TAKE-OFF MODE TESTS.	
1. If removed, install AFCS/MLG accessory unit.		No test.
2. Set flaps to 22 deg.		No test.
3. APFD ENGAGE panel. • Set FD A to ON and B to OFF.		No test.
4. FCES panel. • Depress DLC/AUTO SPLR 1 and 2 to on.		No test.
5. Capt control wheel. • Depress TO/GA sw.	THRUST panel. • ALPHA flag Both ann. • TAKEOFF displayed. Both ADI. • FAST/SLOW ind FAST. Capt ADI. • CMD bars fly up.	Test OK.
	No ALPHA flag, no TAKE OFF displayed, no ADI ind.	Replace pitch computer No. 1 (Ref. 22-11-01). Troubleshoot takeoff mode (Ref. 22-12-29).
	TAKE OFF displayed, bu no ALPHA flag or ADI ind.	Replace speed control computer (Ref. 22-31-07).
6. Set FD A to OFF, then B to ON.	TAKE OFF mode disengaged.	No test.

Speed Control Fault Isolation (Cont)
Table 102

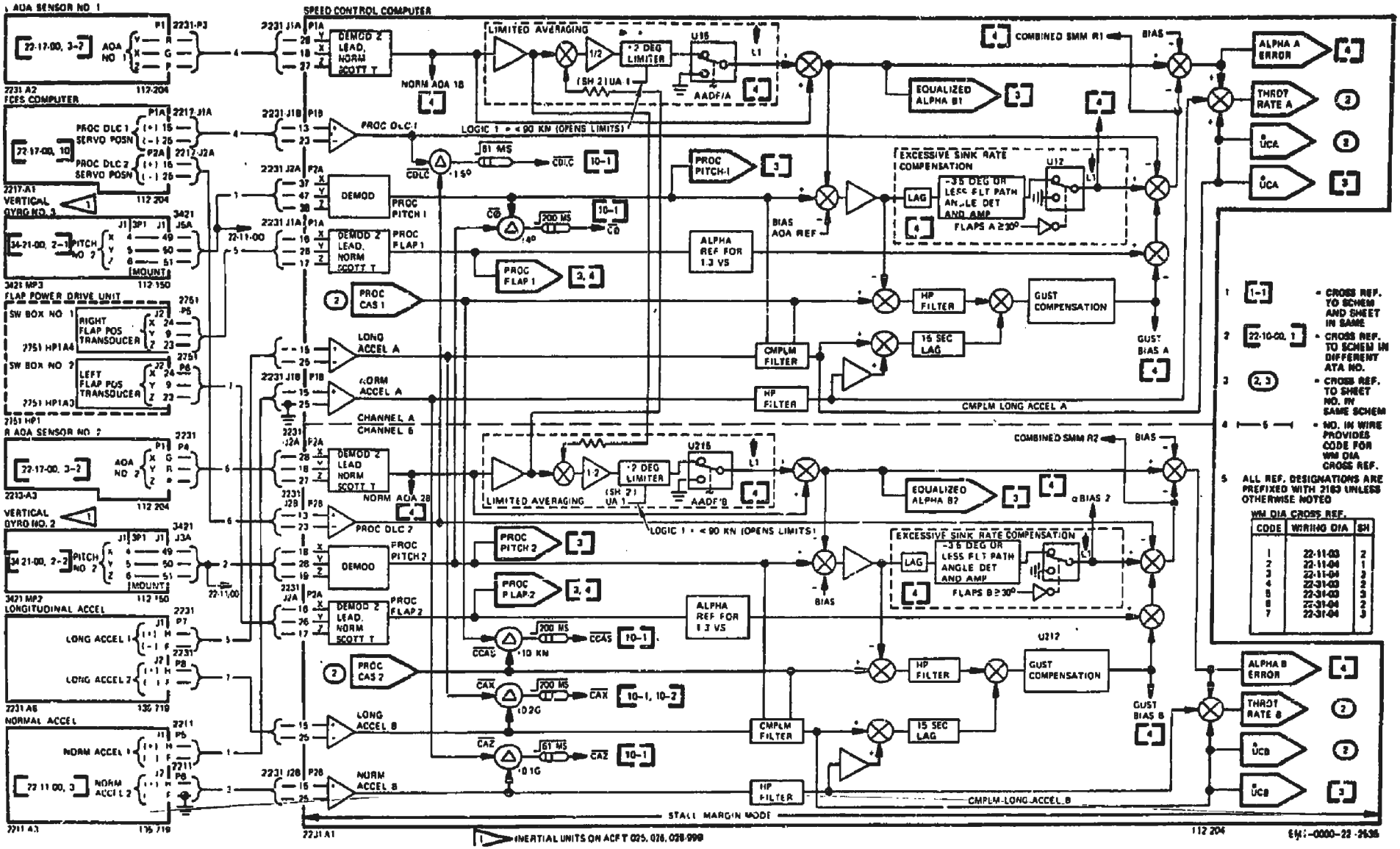
	PROCEDURES	OBSERVATIONS FAULTS	CORRECTIVE ACTION
	7. F/O control wheel. • Depress TO/GA sw.	THRUST panel. • ALPHA flag. Both ann. • TAKEOFF displayed. F/O ADI. • CMD bars fly up. Both ADI • FAST/SLOW ind. FAST.	Test OK.
R R R		No ALPHA flag, no TAKE OFF displayed, no ADI ind.	Replace pitch computer No. 2 (Ref. 22-11-01). Troubleshoot turbulence mode (Ref. 22-11-43).
R R R		TAKE OFF displayed, but no ALPHA flag or ADI ind.	Replace speed control computer (Ref. 22-31-07).
	8. Set FD B to OFF.	TAKE OFF mode disengaged.	No test.
	9. Set all throttles to mid-position.		No test.
	10. THRUST panel. • Attempt to set ATS sw to up.	ATS sw will not move.	Test OK.
		ATS sw moves to up position.	Replace FCES computer. Replace speed control computer.


PILOTS OVHD CB PANEL, CB1
AVIONICS FLIGHT CONTROL SYSTEM NO 1 SYSTEMS SPEED CONT
AVIONICS FLIGHT CONTROL SYSTEM NO 2 SYSTEMS SPEED CONT
AVIONICS FLIGHT CONTROL SYSTEM AUTO THROT SERVO
FE/SO OVHD CB PNL, CB2
AFCS WARNING CAPT
AFCS WARNING F/O
FE/SO AFT CB PANEL, CB3
IND LT FLT CONT ALT ALERT
SPEED CONTROL COMPUTER
DC PWR SUPPLY
PWR SUPPLY MON A
PWR SUPPLY MON B
PSMA
PSMB
DELAY
AUTO THROT SERVO
LONG ACCEL
NO. 1 ACCEL
NO. 2 ACCEL
R-AOA SENSOR NO. 2
L-AOA SENSOR NO. 1
FLAP POWER DRIVE UNIT
SW BOX NO. 1
SW BOX NO. 2
CAPT CONTROL WHEEL A/P DISC
F/O CONTROL WHEEL A/P DISC
CAPT A/T DISC SW (ENG 1 THROT)
F/O A/T DISC SW (ENG 2 THROT)
OPTIONAL DISC +28V DC
IND LTS CONT BOX
LEADING EDGE SLATS PWR DRIVE UNIT
ENG NO. 3 R-THROT SW ASSY
ENG NO. 2 C-THROT SW ASSY
ENG NO. 1 L-THROT SW ASSY
AFCS/MLG ACCESS UNIT
FCES CONTROL PNL
THRUST SELECT PANEL
CAPT AFCS WARN IND
F/O AFCS WARN IND
WM DIA CROSS REF.
CODE
WIRING DIA
SH
NOTE
SEE 22 ABBR FOR ABBREVIATIONS
EM1-1004-22-280

R Speed Control Computer Power Distribution
R SCHEM 1

EFFECTIVITY: ALL

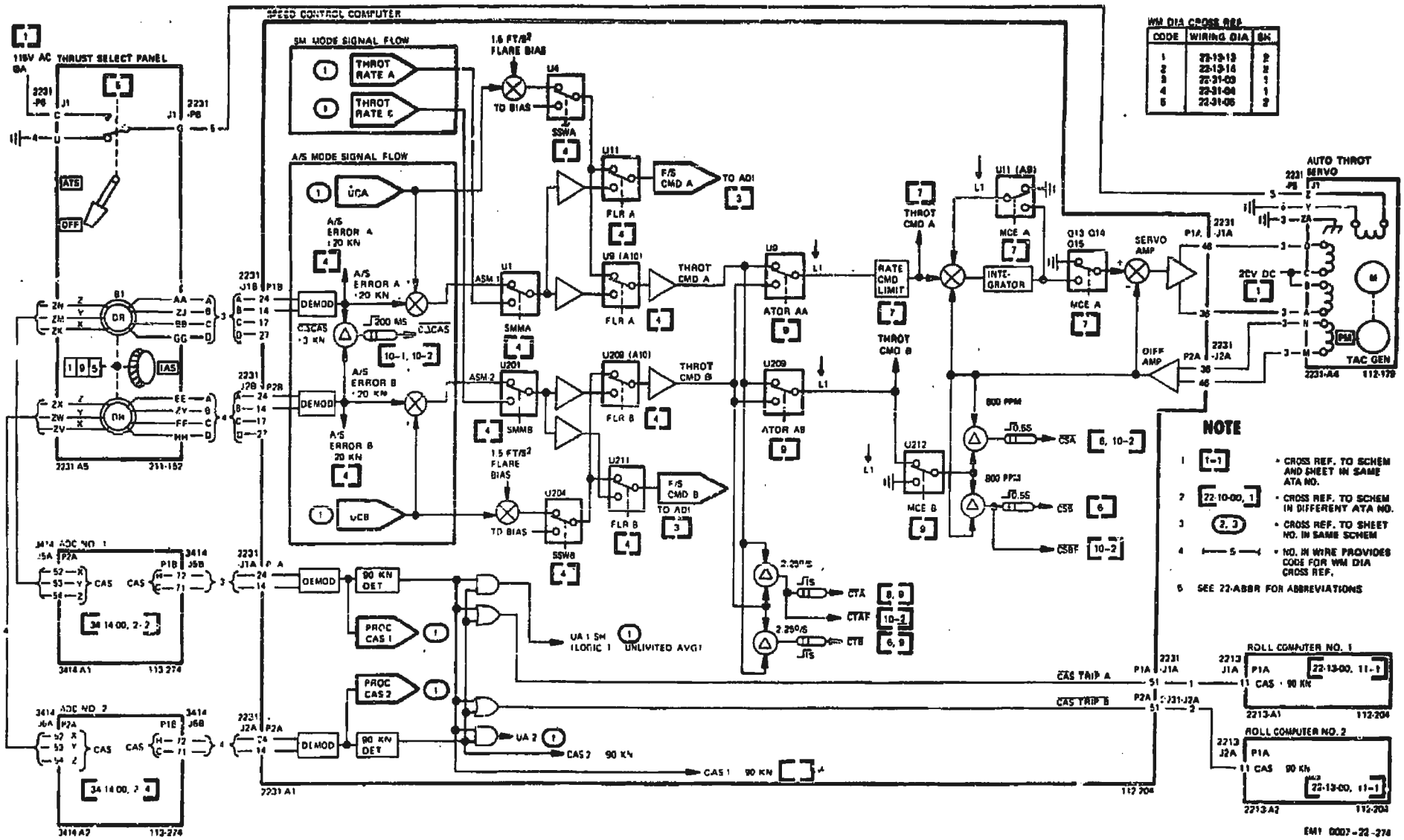
001B


SPEED CONTROL COMPUTER
AOA SENSOR NO 1
FCES COMPUTER
VERTICAL GYRO NO 1
VERTICAL GYRO NO 2
FLAP POWER DRIVE UNIT
R AOA SENSOR NO 2
LONGITUDINAL ACCEL
NORMAL ACCEL
LIMITED AVERAGING
LOGIC 1 = < 90 KN (OPENS LIMITS)
EXCESSIVE SINK RATE COMPENSATION
-35 DEG OR LESS FLT PATH ANGLE DET AND AMP
FLAPS A ≥ 30°
FLAPS B ≥ 30°
COMBINED SMM R1
COMBINED SMM R2
EQUALIZED ALPHA B1
EQUALIZED ALPHA B2
ALPHA REF FOR 1.3 VS
BIAS AOA REF
HP FILTER
GUST COMPENSATION
CMPLM FILTER
15 SEC LAG
GUST BIAS A
GUST BIAS B
CMPLM LONG ACCEL A
CMPLM LONG ACCEL B
STALL MARGIN MODE
CHANNEL A
CHANNEL B
ALPHA A ERROR
THROT RATE A
ALPHA B ERROR
THROT RATE B
1 1-1 - CROSS REF. TO SCHEM AND SHEET IN SAME
2 22-10-00, 1 - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 2, 3 - CROSS REF. TO SHEET NO. IN SAME SCHEM
4 5 - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5 ALL REF. DESIGNATIONS ARE PREFIXED WITH 2183 UNLESS OTHERWISE NOTED
WM DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-11-03 | 2
2 | 22-11-04 | 1
3 | 22-11-04 | 3
4 | 22-31-03 | 2
5 | 22-31-03 | 3
6 | 22-31-04 | 2
7 | 22-31-04 | 3
1 INERTIAL UNITS ON ACFT 025, 026, 028-999

R Autothrottle Signal Flow
R SCHEM 2 (Sheet 1)

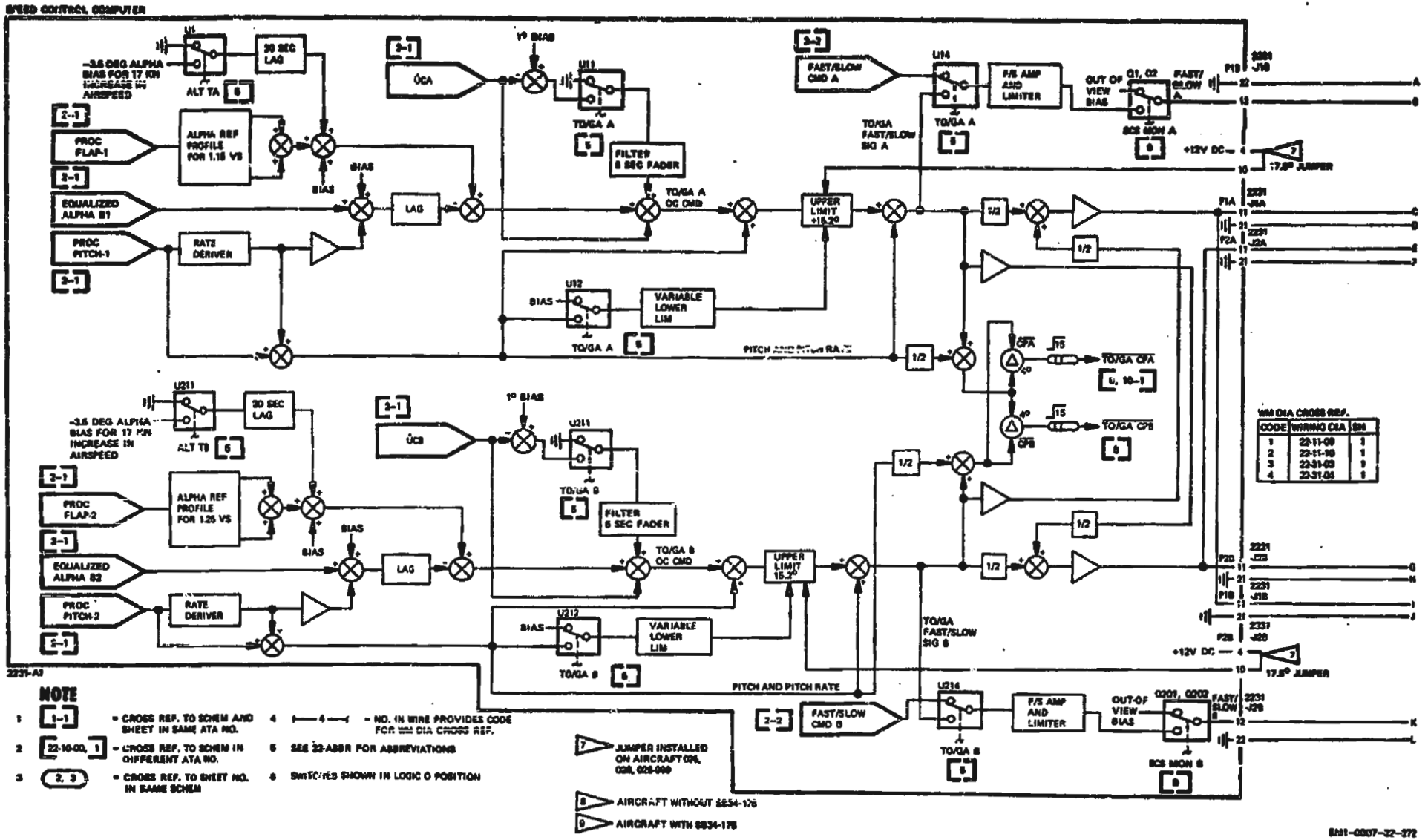
EFFECTIVITY: ALL

001B



R Autothrottle Signal Flow
R SCHEM 2 (Sheet 2)

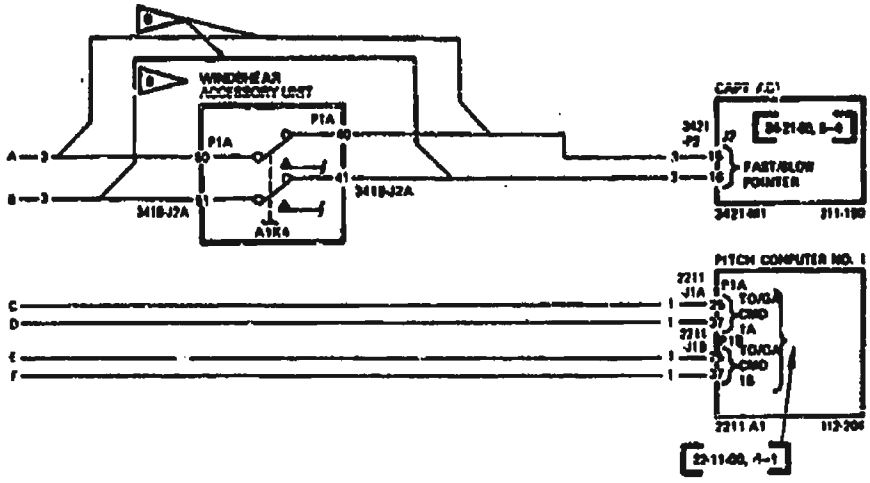
EFFECTIVITY: ALL

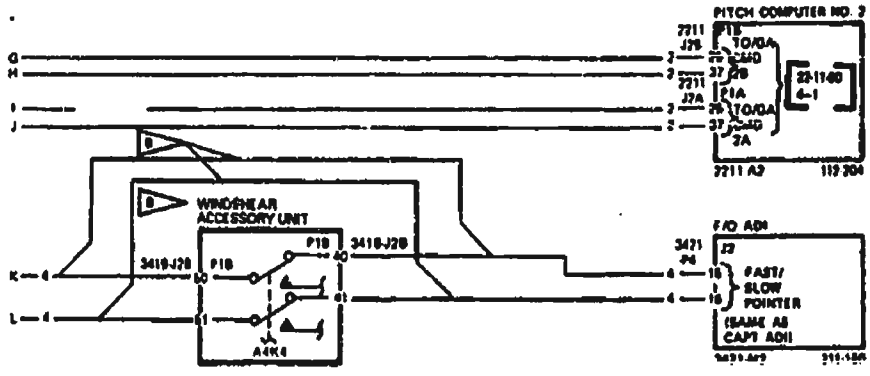


R Takeoff/Go-Around Signal Flow
R SCHEM 3 (Sheet 1)

EFFECTIVITY: ALL

0018



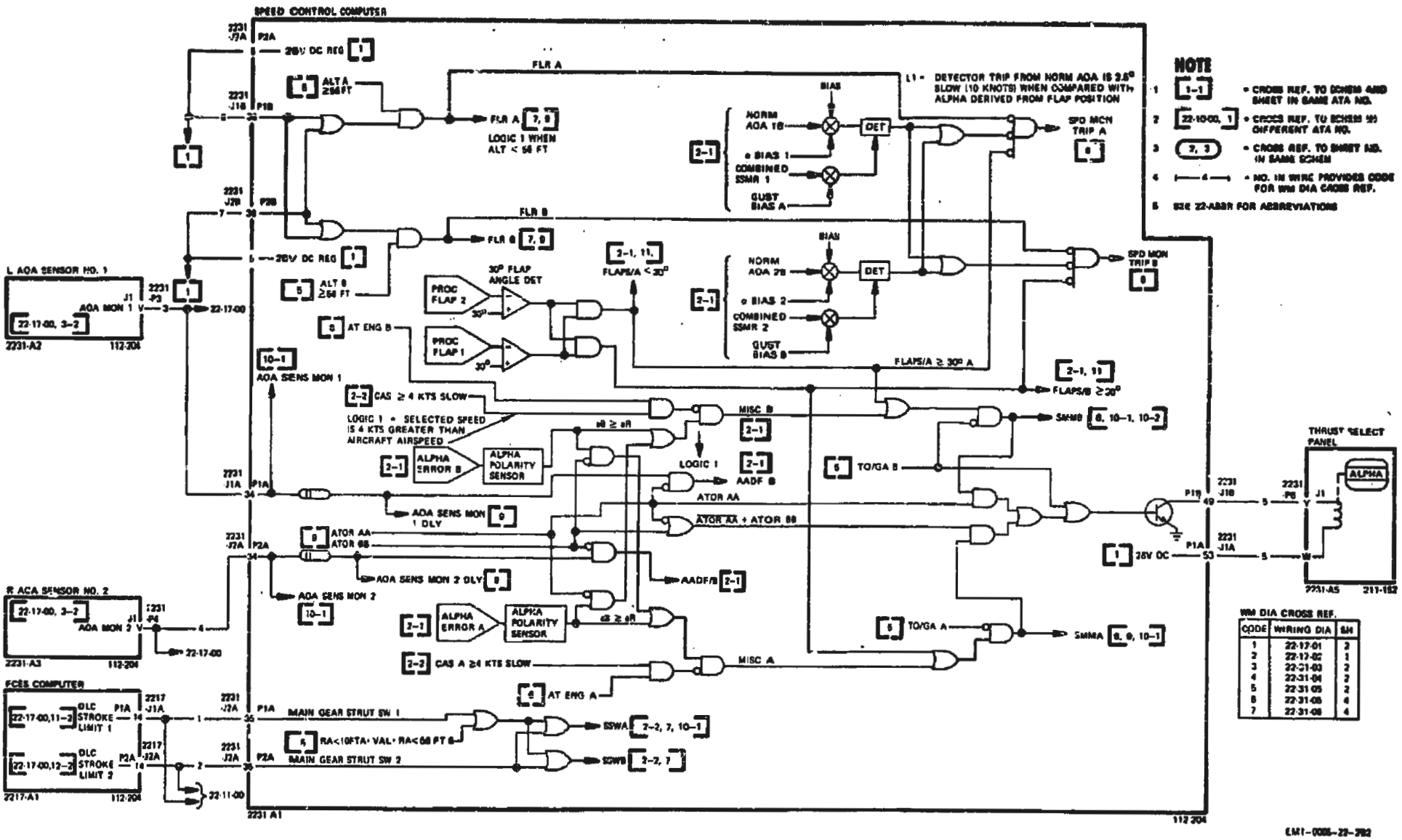


EM1-0000-72-4422

R Takeoff/Go-Around Signal Flow
R SCHEM 3 (Sheet 2)

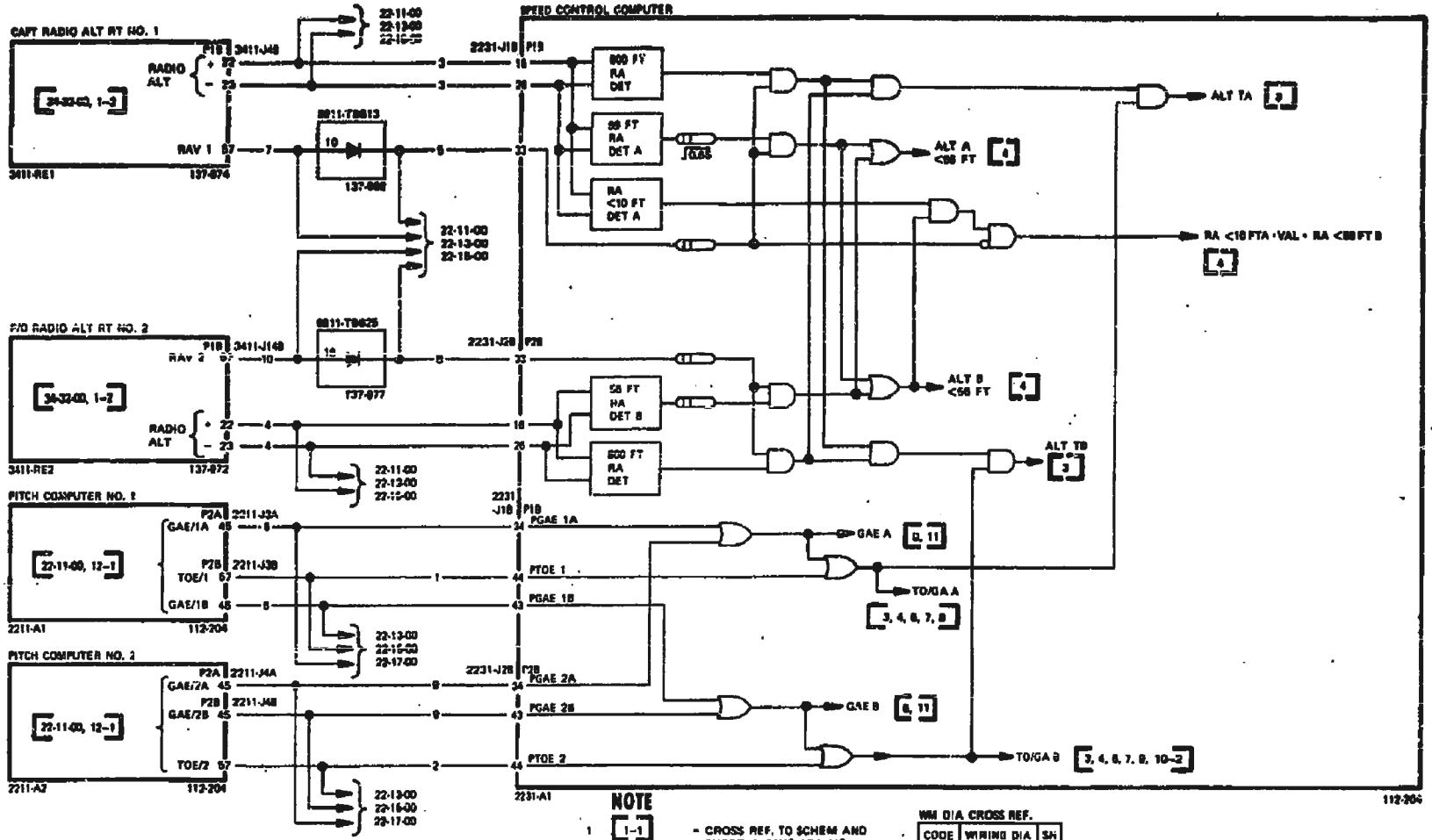
EFFECTIVITY: ALL

001B



Autothrottle Switching and Alpha Annunciation
SCHEM 4

R EFFECTIVITY: ALL
R
001B



NOTE

1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

3 (7, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM

4 —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

5 SEE 22 ABBR FOR ABBREVIATIONS

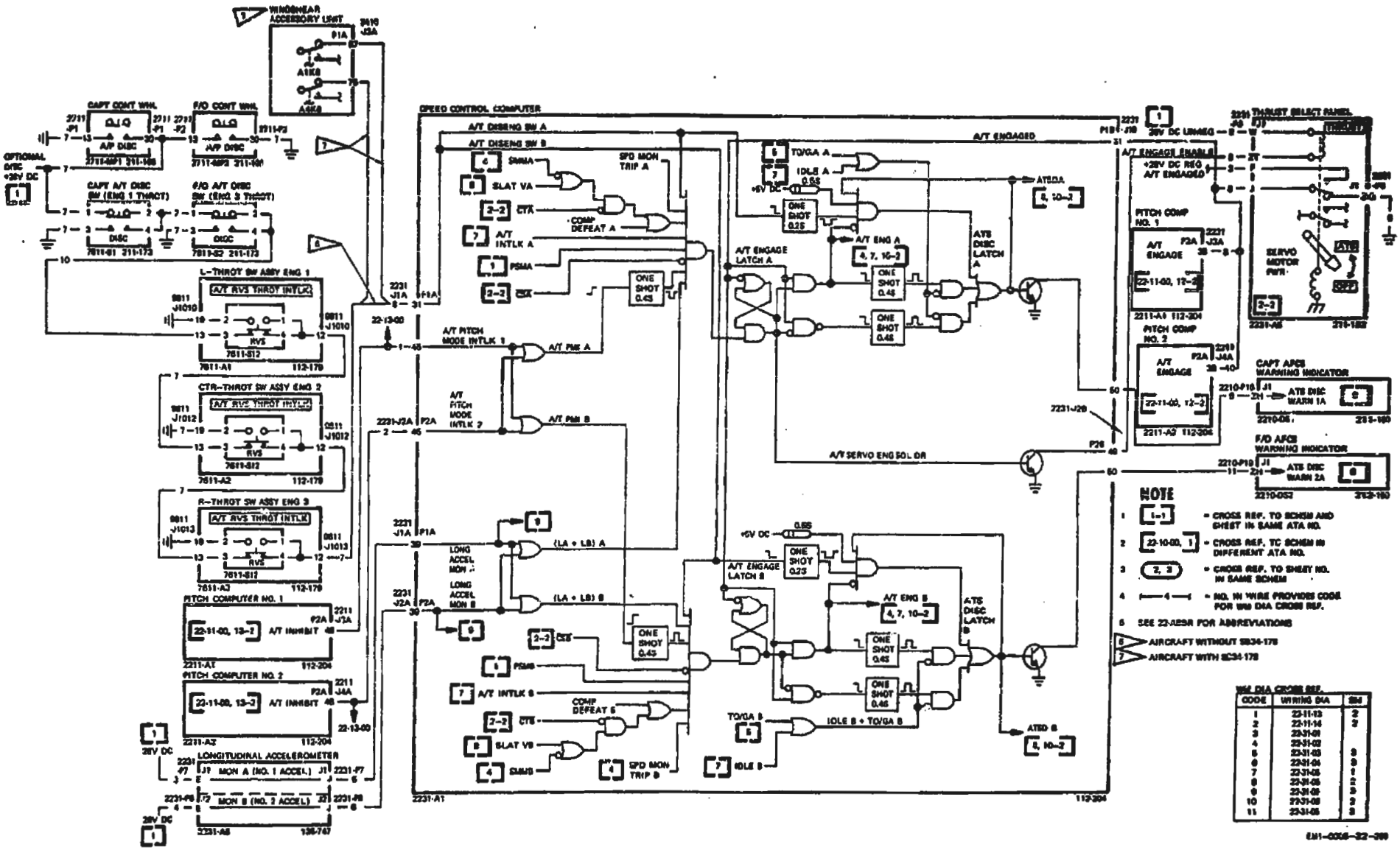
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-10-05	2
2	22-10-05	2
3	22-11-09	2
4	22-11-10	2
5	22-11-18	1
6	22-11-15	3
7	22-11-15	4
8	22-11-18	1
9	22-11-18	3
10	22-11-18	4

EM1-0004-22-270

Takeoff/Go-Around Switching Logic
SCHEM 5

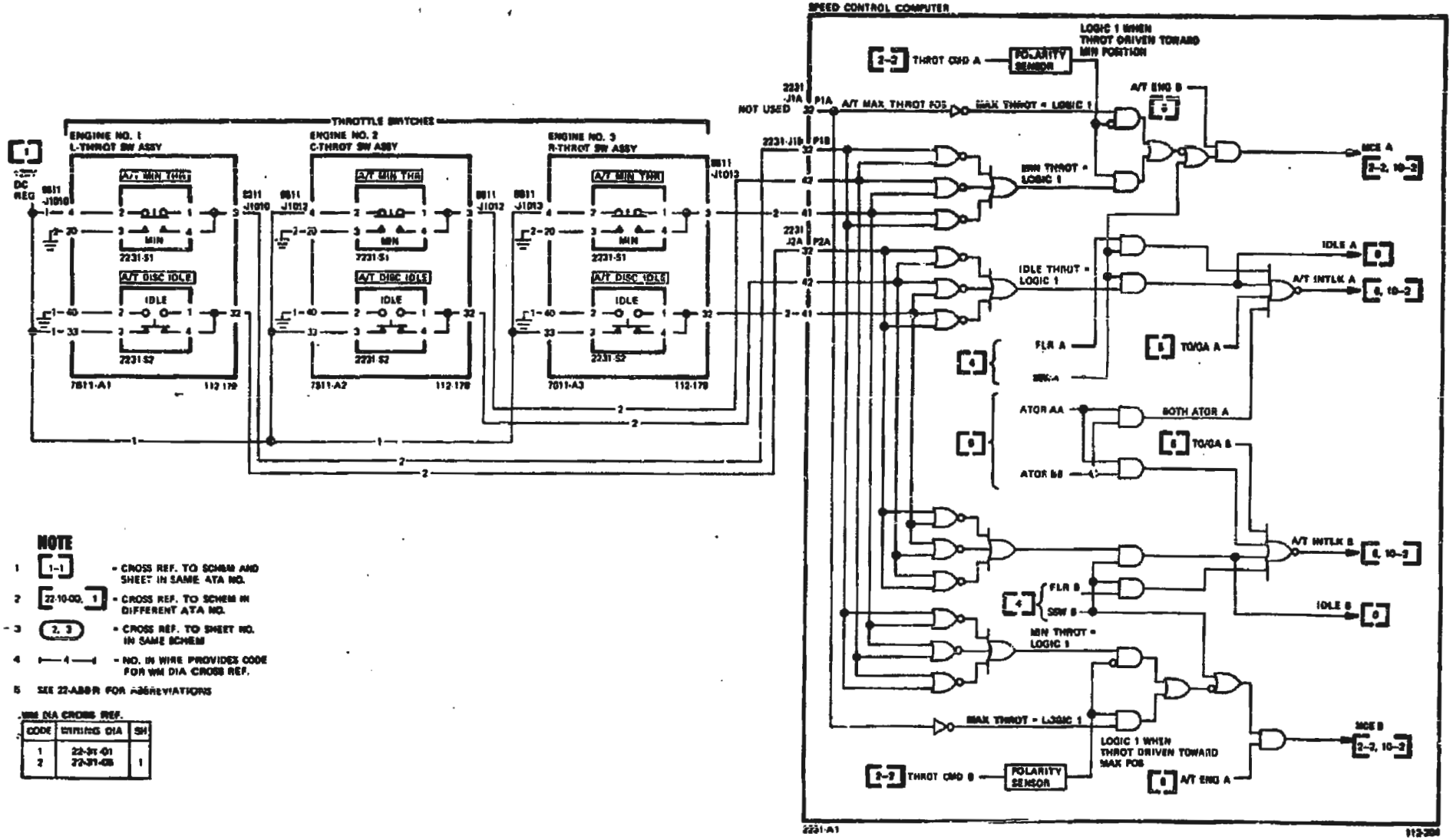
R EFFECTIVITY: ALL
R
001B



R Autothrottle Engage and Disconnect Warning Logic
R SCHEM 6

EFFECTIVITY: ALL

001B



NOTE

1. [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2. [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3. (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4. —4— - NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
5. SEE 22-ABBR FOR ABBREVIATIONS

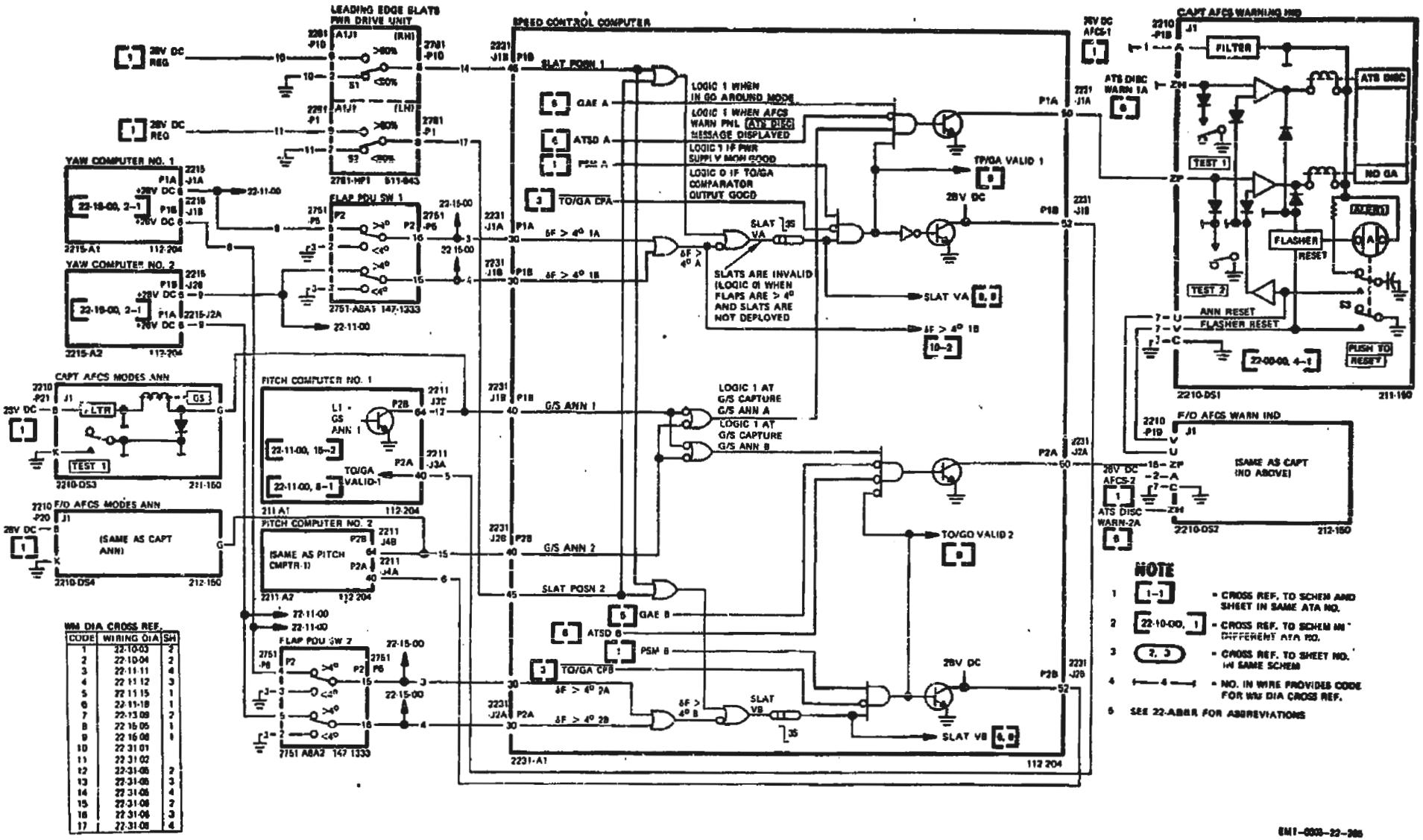
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-31-01	
2	22-31-03	1

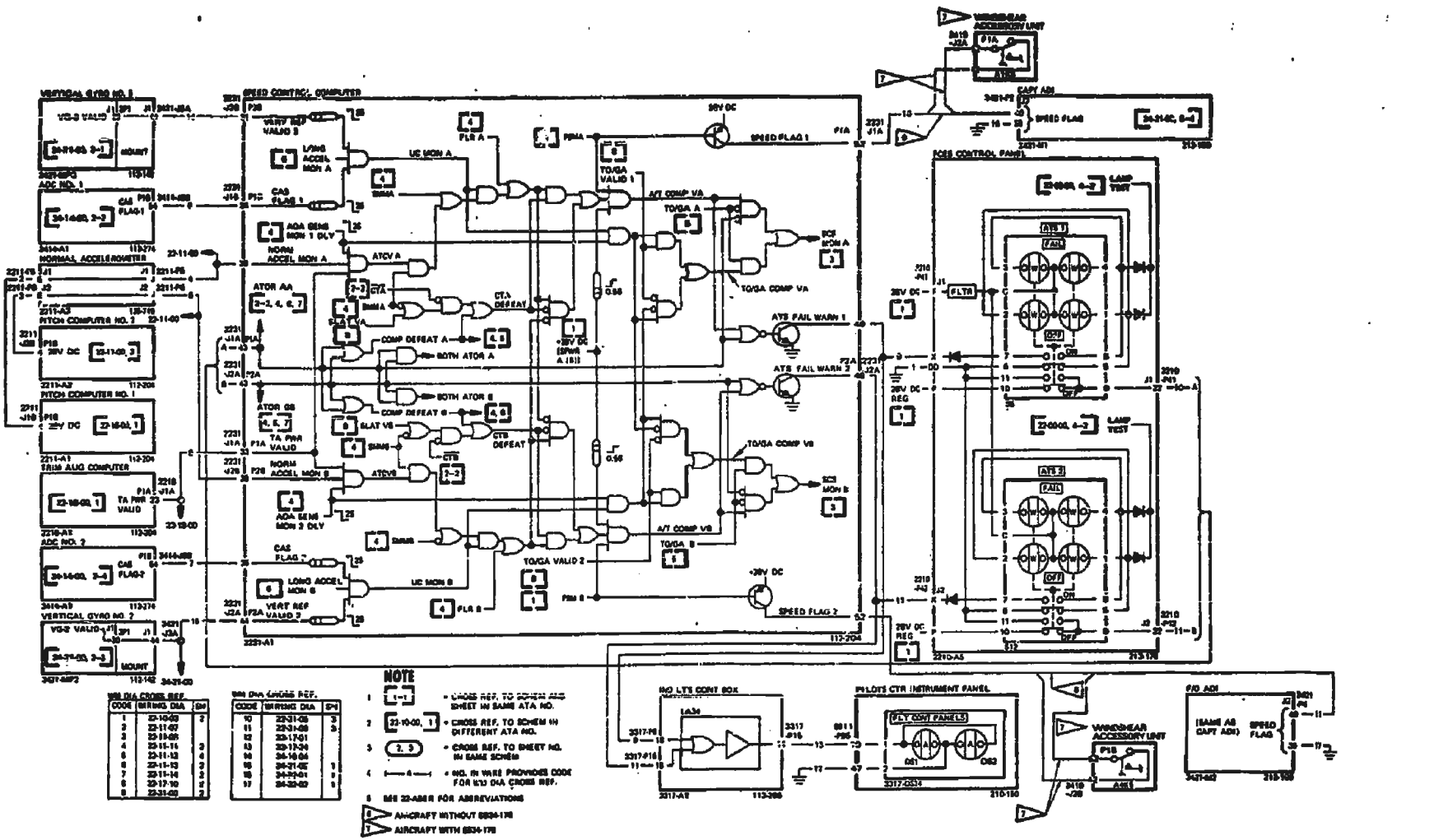
EM1-0004-22-007

Autothrottle Interlock and Motor Control Enable Logic
SCHEM 7

EFFECTIVITY: ALL


LEADING EDGE SLATS PWR DRIVE UNIT
SPEED CONTROL COMPUTER
CAPT AFCS WARNING IND
YAW COMPUTER NO. 1
YAW COMPUTER NO. 2
FLAP PDU SW 1
FLAP PDU SW 2
CAPT AFCS MODES ANN
F/O AFCS MODES ANN
PITCH COMPUTER NO. 1
PITCH COMPUTER NO. 2
F/O AFCS WARN IND
28V DC REG
28V DC AFCS-1
28V DC AFCS-2
SLAT POSN 1
SLAT POSN 2
GAE A
GAE B
ATSD A
ATSD B
PSM A
PSM B
TO/GA CPA
TO/GA CPB
LOGIC 1 WHEN IN GO AROUND MODE
LOGIC 1 WHEN AFCS WARN PNL ATS DISC MESSAGE DISPLAYED
LOGIC 1 IF PWR SUPPLY MON GOOD
LOGIC 0 IF TO/GA COMPARATOR OUTPUT GOOD
TO/GA VALID 1
TO/GA VALID 2
SLAT VA
SLAT VB
SLATS ARE INVALID (LOGIC 0) WHEN FLAPS ARE > 4° AND SLATS ARE NOT DEPLOYED
δF > 4° 1A
δF > 4° 1B
δF > 4° 2A
δF > 4° 2B
G/S ANN 1
G/S ANN 2
LOGIC 1 AT G/S CAPTURE G/S ANN A
LOGIC 1 AT G/S CAPTURE G/S ANN B
ATS DISC WARN 1A
ATS DISC WARN 2A
FILTER
ATS DISC
NO GA
FLASHER
FLASHER RESET
ANN RESET
TEST 1
TEST 2
PUSH TO RESET
(SAME AS CAPT ANN)
(SAME AS CAPT (NO ABOVE))
(SAME AS PITCH CMPTR-1)
WW DIA CROSS REF.
CODE | WIRING DIA | SH
1 | 22-10-03 | 2
2 | 22-10-04 | 2
3 | 22-11-11 | 4
4 | 22-11-12 | 3
5 | 22-11-15 | 1
6 | 22-11-18 | 1
7 | 22-13-09 | 2
8 | 22-16-05 | 1
9 | 22-16-08 | 1
10 | 22-31-01
11 | 22-31-02
12 | 22-31-05 | 2
13 | 22-31-05 | 3
14 | 22-31-05 | 4
15 | 22-31-06 | 2
16 | 22-31-06 | 3
17 | 22-31-06 | 4
NOTE
1 [1-1] - CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.
2 [22-10-00, 1] - CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 (2, 3) - CROSS REF. TO SHEET NO. IN SAME SCHEM
4 —4— - NO. IN WIRE PROVIDES CODE FOR WW DIA CROSS REF.
5 SEE 22-ABBR FOR ABBREVIATIONS

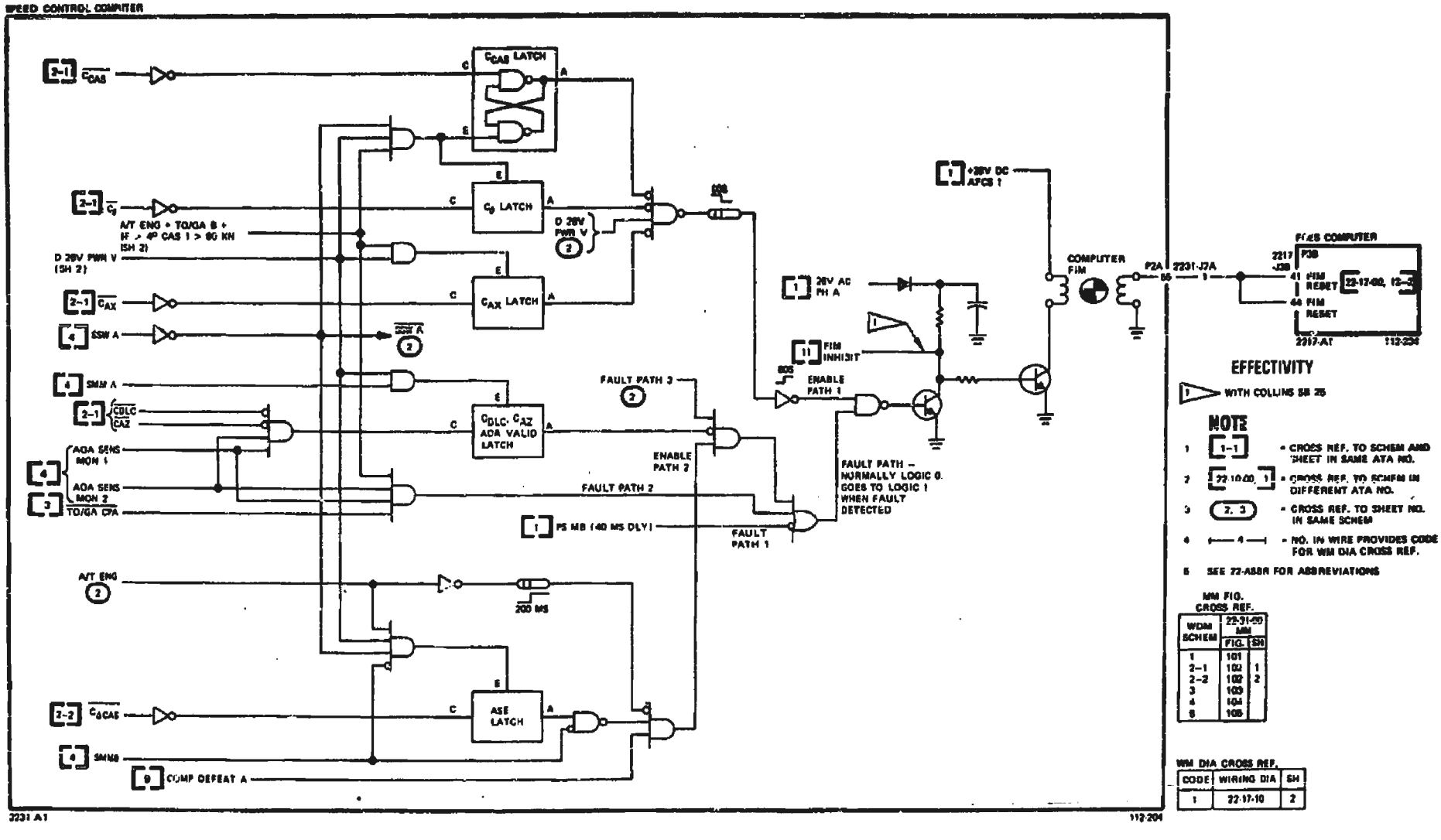
Takeoff/Go-Around Valid and No Go-Around Annunciation Logic
SCHEM 8



R Speed Control System Monitor Logic
R SCHEM 9

EFFECTIVITY: ALL

001B



EFFECTIVITY

1 WITH COLLINS SB 25

NOTE

1 [1-1] = CROSS REF. TO SCHEM AND SHEET IN SAME ATA NO.

2 [22-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

3 (2, 3) = CROSS REF. TO SHEET NO. IN SAME SCHEM

4 ⟵4⟶ = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

5 SEE 22-ASBR FOR ABBREVIATIONS

WM FIG. CROSS REF.

WDM SCHEM	22-31-00 WM FIG.	SH
1	101	
2-1	102	1
2-2	102	2
3	103	
4	104	
5	105	

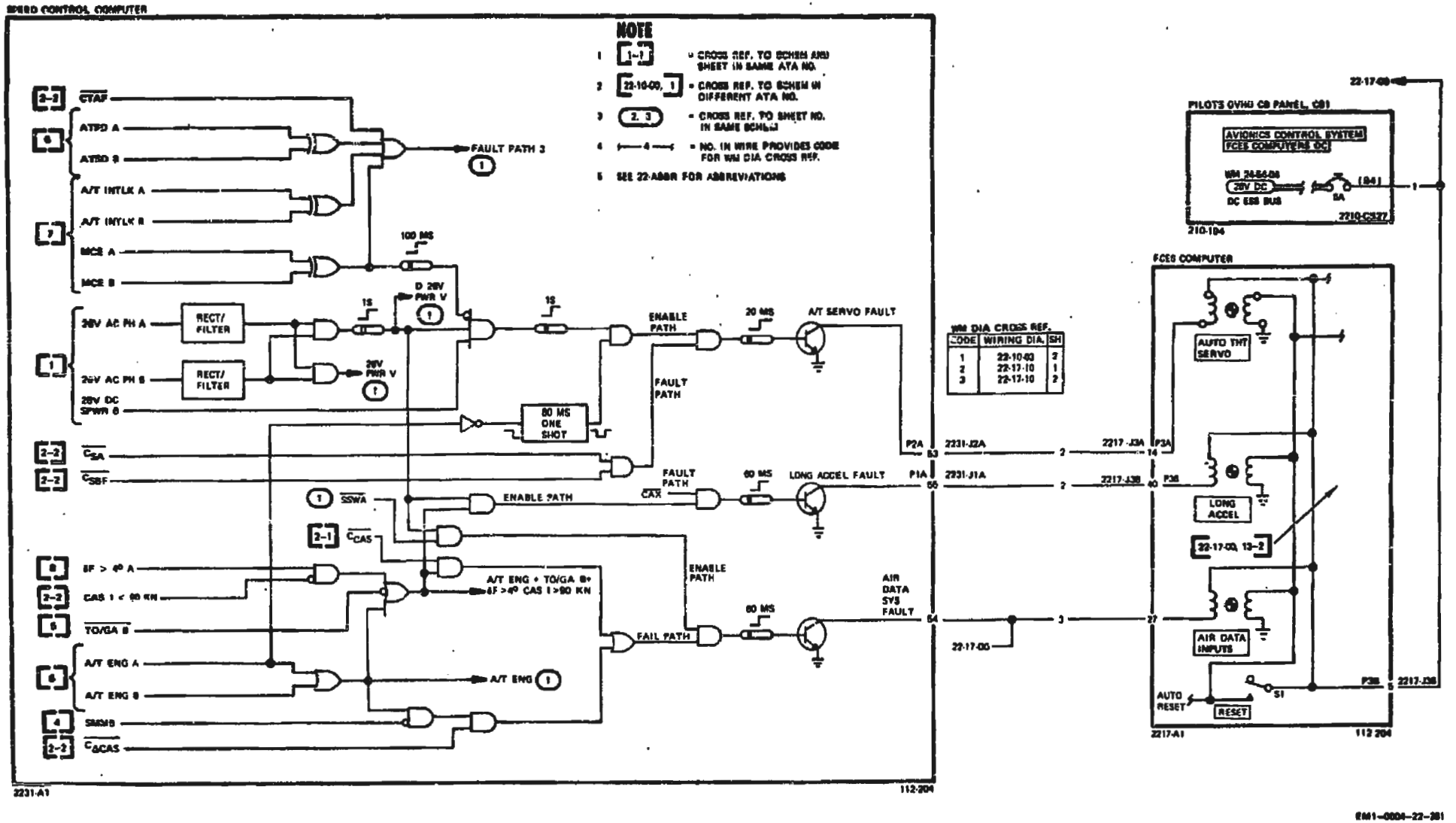
WM DIA CROSS REF.

CODE	WIRING DIA	SH
1	22-17-10	2

EM1-0004-22-280

Speed Computer FIM
SCHEM 10 (Sheet 1)

R EFFECTIVITY: ALL
R
0018



Speed Computer FIM
SCHEM 10 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

SPEED CONTROL SYSTEM (AUTOTHROTTLE SYSTEM) MAINTENANCE PRACTICES

1. General

Deactivation of the auto throttle system is necessary when the auto throttle servo, ATS clutch assembly, thrust select panel, or ATS gear box becomes inoperative. The following procedure specifies the method used to deactivate the auto throttle system if the aircraft is to be dispatched with units one or more inoperative.

2. Maintenance practices

A. Deactivation

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

(1) On FCES control panel, depress ATS-1 and ATS-2 switchlights to indicate OFF.

(2) Placard flight station AUTOTHROTTLE SYSTEM DEACTIVATED, AUTOLAND AVAILABLE WITH MANUAL THROTTLE.

(3) Make appropriate entry in aircraft log book.

SPEED CONTROL SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

Type MB-1 Pitot/Static Field Tester; Burton 2024B Pitot/Static Tester; or equivalent (2 req).

NOTE: Refer to Chapter 34 Illustrated Tool and Equipment Manual for description and operation.

2. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-00	Ram Air Turbine - Maintenance Practices
34-14-00	Central Air Data Computer System - Maintenance Practices
34-21-00	Attitude Reference System - Maintenance Practices
34-32-00	Radio Altimeter System - Maintenance Practices

3. Adjustment/Test

The speed control system functional test provided below requires that associated equipment are installed and operational.

A. Preparation

WARNING: DO NOT ENGAGE THE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics cooling is on (Ref. 21-00-00).

(3) Verify that the following systems are on:

Central air data computer system (Ref. 34-14-00)

Attitude reference system (Ref. 34-21-00)

Radio altimeter system (Ref. 34-32-00)

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS - SPEED CONT (A2)

NO. 2 SYSTEMS - SPEED CONT (A20)

AFCS MODE IND (B1 and B19)

FCES COMPUTERS AC & L AOA (B5)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breakers R AOA (F1), AFCS WARNING - CAPT (K18) and F/O (K19) are closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

(5) On pilots overhead circuit breaker panel CB1, open and tag MISC RAT AUTO DEPLOY (L3) circuit breaker.

(6) Install rat ground safety lock (Ref. 29-21-00).

R (7) Simulate airborne condition by either removing the AFCS/MLG ACCESSORY UNIT or by opening MLG GND SENSE (L8) or GEAR TRUCK LEVEL (F16) circuit breaker on panel CB2.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

PITCH TRIM WHEEL IS AT ZERO DEGREES.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic power (Ref. 29-11-00).

(9) Connect pitot/static field testers to CADC systems No. 1 and 2. On each tester, establish an IAS of 170 knots (Ref. 34-14-00).

(10) Set flaps to zero degrees.

(11) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(12) On APFDS ENGAGE panel, set both FD switches to ON, and verify that both autopilot engage switches are OFF.

B. Autothrottle Operational Test

NOTE: If, when carrying out the Adjustment/Test procedures, either AOA Probe drifts sufficiently to cause incorrect test results and the aircraft does not have an AOA defect history, proceed as follows:

- For L AOA, at panel CB1 trip circuit breaker B5, and/or
- For R AOA, at panel CB2 trip circuit breaker F1.
- Manually position the AOA Probe/s to nominal horizontal attitude and hold.
- Whilst restraining the probe/s, reset circuit breakers B5 and/or F1 and carry out required tests.

(1) On FCES control panel, verify that ATS 1 and 2 switchlights are on (latched in).

WARNING: ENSURE THAT AUTOTHROTTLE CLUTCH ASSEMBLY AREA IS CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(2) On THRUST panel, set IAS knob to 180 knots.

(3) Set all throttle levers to mid-position.

(4) On THRUST panel, set ATS switch to ON. ATS switch remains in ON position. All throttle levers drive forward to maximum thrust limit and stop. Both ADI FAST/SLOW displays indicate SLOW.

R NOTE: Because of combined system tolerances when any
R two or all three throttles are at the maximum
R thrust limit stop, the ATS may or may not
R disconnect with ATS DISC and a flashing ALERT
R light appearing on the AFCS Warning Indicator
R Display. If the ATS disconnects under these

R conditions, the throttles must be backed off and
R the ATS switch placed in the ON position.

(5) On THRUST panel, set IAS knob to 160 knots. All throttle levers drive aft to minimum thrust limit and stop. Both ADI FAST/SLOW displays indicate FAST.

(6) Depress left autothrottle disengage switch. ATS switch drops to off, and AFCS WARNING indicators display ATS DISC and flashing ALERT.

(7) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(8) On THRUST panel, set ATS switch to ON.

(9) Depress right autothrottle disengage switch. ATS switch drops to off, and AFCS WARNING indicators display ATS DISC and flashing ALERT.

(10) Depress right autothrottle disengage switch to turn off AFCS WARNING indications.

(11) On THRUST panel, set ATS switch to ON.

(12) On HEADING/PITCH MODE panel, depress VS switchlight on, then off. ATS switch remains in ON position.

(13) On HEADING/PITCH MODE panel, depress ALT switchlight on, then off. ATS switch remains in ON position.

(14) On NAV MODE panel, depress APR switchlight on, then off. ATS switch remains in ON position.

(15) On NAV MODE panel, depress A/L switchlight on, then off. ATS switch remains in ON position.

(16) On HEADING/PITCH MODE panel, depress MACH switchlight on, then off. ATS switch drops to OFF. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(17) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(18) On THRUST panel, set ATS switch to ON.

(19) On HEADING/PITCH MODE panel, depress IAS switchlight on, then off. ATS switch drops to OFF. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(20) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(21) On THRUST panel, set ATS to ON.

(22) On APFDS ENGAGE panel, set AP switch A to CWS.

(23) On APFDS ENGAGE panel, depress TURB switchlight on, then off. ATS switch drops to OFF. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(24) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(25) On Captains control wheel, depress A/P disengage switch twice. On APFDS ENGAGE panel, A/P A switch drops to OFF.

(26) On THRUST panel, set ATS switch to ON.

(27) On Captains control wheel, depress GO AROUND switch. On THRUST panel, ATS switch drops to OFF, ALPHA flag is in view. GO AROUND indications are displayed on AFCS MODES indicators.

(28) On APFDS ENGAGE panel, set both FD switches to OFF and back ON to turn off GO AROUND mode.

(29) On THRUST panel, set ATS switch to ON.

(30) On First Officers control wheel, depress GO AROUND switch. On THRUST panel, ATS switch drops to OFF, ALPHA flag is in view. GO AROUND indications are displayed on AFCS MODES indicators.

(31) On APFDS ENGAGE panel, set both FD switches to OFF then back to ON to turn OFF GO AROUND mode.

(32) On THRUST panel, set ATS switch to ON.

(33) Revert to on ground condition by reversing ACTION taken in Step 3A(7). On THRUST panel, ATS switch drops to OFF. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(34) Return to airborne condition using ACTION taken in Step 3A(7).

(35) On THRUST panel, set ATS switch to ON.

(36) On CB1, close D4 circuit breaker and verify that radio altitude display indicates less than 10 ft. On THRUST panel, ATS switch drops to OFF. (ATS switch drops to OFF only if Speed Computer has modification No. 23 accomplished.)

(37) Revert to on ground condition by reversing ACTION taken in Step 3A(7).

C (38) On Captains control wheel, depress GO AROUND switch.
C On THRUST panel, ALPHA flag is in view. TO/GA
C indicators are displayed on AFCS MODES indicators.

C (39) On APFDS ENGAGE panel, set both FD switches to OFF,
C then back to ON to turn off TAKEOFF mode.

C (40) On First Officers control wheel, depress GO AROUND switch. On THRUST panel, ALPHA flag is in view. TO/GA indicators are displayed on AFCS MODES indicators.

C. Test Completion

(1) On APFDS ENGAGE panel, set both FD switches to OFF.

(2) Disconnect both testers from CADC systems No. 1 and 2 (Ref. 34-14-00).

(3) In FESC, center rack, set LRS computer BITE switch to RESET for 5 seconds then return to RUN. Verify that CADC fail indicator on LRS computer has reset (BLACK).

(4) Remove rat ground safety lock (Ref. 29-21-00).

(5) On pilots overhead circuit breaker panel CB1, remove tag and close MISC RAT AUTO DEPLOY (L3) circuit breaker. On CB1, close D22 circuit breaker.

(6) Turn off hydraulic power (Ref. 29-11-00).

(7) Turn off electrical power (Ref. 24-00-00).

SPEED CONTROL SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedures

21-00-00	Air Conditioning System - Maintenance Practices
24-00-00	Electrical Power - Maintenance Practices
29-11-00	Hydraulic Power System - Maintenance Practices
29-21-00	Ram Air Turbine - Maintenance Practices
34-14-00	Air Data Computer System - Maintenance Practices
34-32-00	Radio Altimeter System - Maintenance Practices

2. Adjustment/Test

The speed control system functional test provided below requires that associated equipment are installed and operational.

A. Preparation

WARNING: DO NOT ENGAGE THE AUTOPILOT WHEN THE AIRCRAFT IS ON JACKS.

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that avionics is on (Ref. 21-00-00).

(3) Verify that the following systems are on:

Air data computer system (Ref. 34-14-00)

Radio altimeter system (Ref. 34-32-00)

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS - SPEED CONT (A2)

NO. 2 SYSTEMS - SPEED CONT (A20)

AFCS MODE IND (B3 and B19)

FCES COMPUTERS AC & L AOA (B5)

INS-1 (G6)

INS HTR (E6)

INS PWR (E7)

INS-2 (G24)

INS-2 (G25)

INS-3 (E24)

INS-3 (E25)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breakers R AOA (F1), AFCS WARNING - CAPT (K18) and F/O (K19) are closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT ALT ALERT (G9) is closed.

(5) On pilots overhead circuit breaker panel CB1, open and tag MISC RAT AUTO DEPLOY (L3) circuit breaker.

(6) Install rat ground safety lock (Ref. 29-21-00).

(7) Simulate 'airborne' condition by either removing the AFCS/MLG ACCESSORY UNIT or by opening MLG GND SENSE (L8) or GEAR TRUCK LEVEL (F16) circuit breaker on panel CB2.

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(8) Turn on hydraulic power (Ref. 29-11-00).

(9) Set flaps to zero degrees.

(10) On CB1, open NO. 1 NAVIGATION RADIO ALTM (D4) circuit breaker.

(11) On all mode selector panels, set mode selector switch to ATT. When both ADI ATT flags go out of view and ATT 3 legend goes out, the autopilot and flight director can be engaged.

(12) On APFDS ENGAGE panel, set both FD switches to ON, and verify that both autopilot bat handles are OFF.

B. Autothrottle Operational Test

NOTE: If, when carrying out the Adjustment/Test procedures, either AOA Probe drifts sufficiently to cause incorrect test results and the aircraft does not have an AOA defect history, proceed as follows:

- For L AOA, at panel CB1 trip circuit breaker B5, and/or
- For R AOA, at panel CB2 trip circuit breaker F1.
- Manually position the AOA Probe/s to nominal horizontal attitude and hold.
- Whilst restraining the probe/s, reset circuit breakers B5 and/or F1 and carry out required tests.

(1) On FCES control panel, verify that ATS 1 and 2 switchlights are on (dark).

WARNING: ENSURE THAT AUTOTHROTTLE CLUTCH ASSEMBLY AREA IS CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(2) On THRUST panel, set IAS knob to 300 knots.

(3) Set all throttle levers to mid-position.

NOTE: Steps (4) through (9) check autothrottle operation using the digital air data computer (DADC) self test program.

(4) On both digital air data computers (DADC), simultaneously depress PUSH TO TEST switches for 1 second and release. When all air data instrument flags come in view, verify that ATS 1 and 2 switchlights indicate FAIL, and that FD flag is in view and command bars are biased out of view on both ADI.

(5) When the TEST IN PROGRESS lights on the DADC start to flash [approximately 10 seconds after start of self

test in Step (4)], simultaneously depress PUSH TO TEST switches on DADC for 1 second and release to initiate programmed airspeed output.

(6) Press ATS 1 and 2 switchlights to OFF, then to on to clear FAIL.

(7) At approximately 1.3 min after initiating programmed airspeed outputs, as IAS is decreasing toward 280 knots on THRUST panel, set ATS bathandle to ATS. ATS bathandle remains in ATS position. All throttle levers drive forward to maximum thrust limit and stop. Both ADI FAST/SLOW displays indicate SLOW.

R NOTE: Because of combined system tolerances when any
R two or all three throttles are at the maximum
R thrust limit stop, the ATS may or may not
R disconnect with ATS DISC and a flashing ALERT
R light appearing on the AFCS Warning Indicator
R Display. If the ATS disconnects under these
R conditions, the throttles must be backed off and
R the ATS switch placed in the ON position.

(8) As airspeed begins to increase through 300 knots all throttle levers drive aft to minimum thrust limit and stop. Both ADI FAST/SLOW displays indicate FAST.

(9) Depress left autothrottle disengage switch. ATS bathandle drops to OFF, and AFCS WARNING indicators display ATS DISC and flashing ALERT.

(10) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(11) Set ATS bathandle to ATS.

(12) Depress right autothrottle disengage switch. ATS bathandle drops to OFF, and AFCS WARNING indicators display ATS DISC and flashing ALERT.

(13) Depress right autothrottle disengage switch to turn off AFCS WARNING indications.

(14) Set ATS bathandle to ATS.

(15) On HEADING/PITCH MODE panel, depress VS switchlight on, then off. ATS bathandle remains in ATS position.

(16) On HEADING/PITCH MODE panel, depress ALT switchlight on, then off. ATS bathandle remains in ATS position.

(17) On NAV MODE panel, depress APR switchlight on, then off. ATS bathandle remains in ATS position.

(18) On NAV MODE panel, depress A/L switchlight on, then off. ATS bathandle remains in ATS position.

(19) On HEADING/PITCH MODE panel, depress MACH switchlight to on, then off. ATS bathandle drops to off. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(20) Depress left autothrottle disengage switch to turn off AFCS WARNING indicators.

(21) Set ATS bathandle to ATS.

(22) On HEADING/PITCH MODE panel, depress IAS switchlight on, then off. ATS bathandle drops to OFF. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(23) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(24) Set ATS bathandle to ATS.

(25) On APFDS ENGAGE panel, set AP bathandle A to CWS.

(26) On APFDS ENGAGE panel, depress TURB switchlight on, then off. ATS bathandle drops to OFF. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(27) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(28) On Captains control wheel, depress A/P disengage switch twice. On APFDS ENGAGE panel, A/P A bathandle drops to OFF.

(29) Set ATS bathandle to ATS.

(30) On Captains control wheel, depress GO AROUND switch. On THRUST panel, ATS bathandle drops to OFF, and ALPHA flag is in view. GO AROUND indications are displayed on AFCS MODES indicators.

(31) On APFDS ENGAGE panel, set both FD switches to OFF and back ON to turn off GO AROUND mode.

(32) Set ATS bathandle to ATS.

(33) On First Officers control wheel, depress GO AROUND switch. ATS bathandle drops to OFF. ALPHA flag is in

view. GO AROUND indications are displayed on AFCS MODES indicators.

(34) On APFDS ENGAGE panel, set both FD switches to OFF then back to ON to turn OFF GO AROUND mode.

(35) Set ATS bathandle to ATS.

(36) Revert to "on ground" condition by reversing ACTION taken in Step 2A(7). ATS bathandle drops to OFF. AFCS WARNING indicators display ATS DISC and flashing ALERT.

(37) Return to "airborne" condition using ACTION taken in Step 2A(2).

(38) Set ATS bathandle to ATS.

(39) On CB1, close D4 circuit breaker and verify that radio altitude display indicates less than 10 ft. ATS bathandle drops to OFF.

(40) Revert to "on ground" condition by reversing ACTION taken in Step 2A(7).

(41) Depress left autothrottle disengage switch to turn off AFCS WARNING indications.

(42) On Captains control wheel, depress GO AROUND switch. ALPHA flag comes in view. TAKE OFF indications are displayed on AFCS MODES indicators.

(43) On APFDS ENGAGE panel, set both FD switches to OFF, then back to ON to turn off TAKEOFF mode.

(44) On First Officers control wheel, depress GO AROUND switch. ALPHA flag comes in view. TAKE OFF indications are displayed on AFCS MODES indicators.

(45) Set both FD switches to OFF, then back ON to turn off TAKEOFF mode.

C. Test Completion

(1) On APFDS ENGAGE panel, set both FD switches to OFF.

CAUTION: INS BATTERIES MAY BE DISCHARGED UPON REMOVAL OF AIRCRAFT POWER, IF MODE SELECTOR SWITCH IS NOT SET TO OFF.

(2) On all mode selector panels, set mode selector switch to OFF.

(3) Remove rat ground safety lock (Ref. 29-21-00).

(4) On pilots overhead circuit breaker panel CB1, remove tag and close MISC RAT AUTO DEPLOY (L3) circuit breaker.

(5) Turn off hydraulic power (Ref. 29-11-00).

(6) Turn off electrical power (Ref. 24-00-00).

AUTO THROTTLE SERVO - REMOVAL AND INSTALLATION

1. Referenced Procedures

   22-31-01 Autothrottle Servo - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers AVIONICS FLIGHT CONTROL SYSTEM - AUTO THROT SERVO (A1) and AVIONICS FLIGHT CONTROL SYSTEM - NO 1 SYSTEMS - SPEED CONT (A2).

      (2) Open access door 112AB and enter forward electronics service center, zone 112. Locate autothrottle servo directly below pilots throttle control area near service center ceiling (Ref. Fig. 401).

      (3) Disconnect electrical connector from servo.

      (4) Support servo and remove screws, washers, and nuts securing servo to autothrottle servo gearbox, and remove servo.

   B. Installation

      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Position autothrottle servo (Ref. Fig. 401) against servo gearbox, with servo splined output shaft inserted into gearbox and mounting holes aligned.

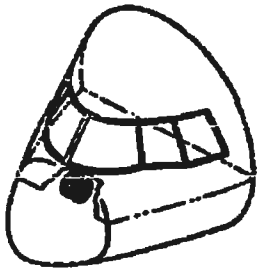
      (3) Install and tighten mounting screws, washers, and nuts.

      (4) Connect electrical connector to servo.

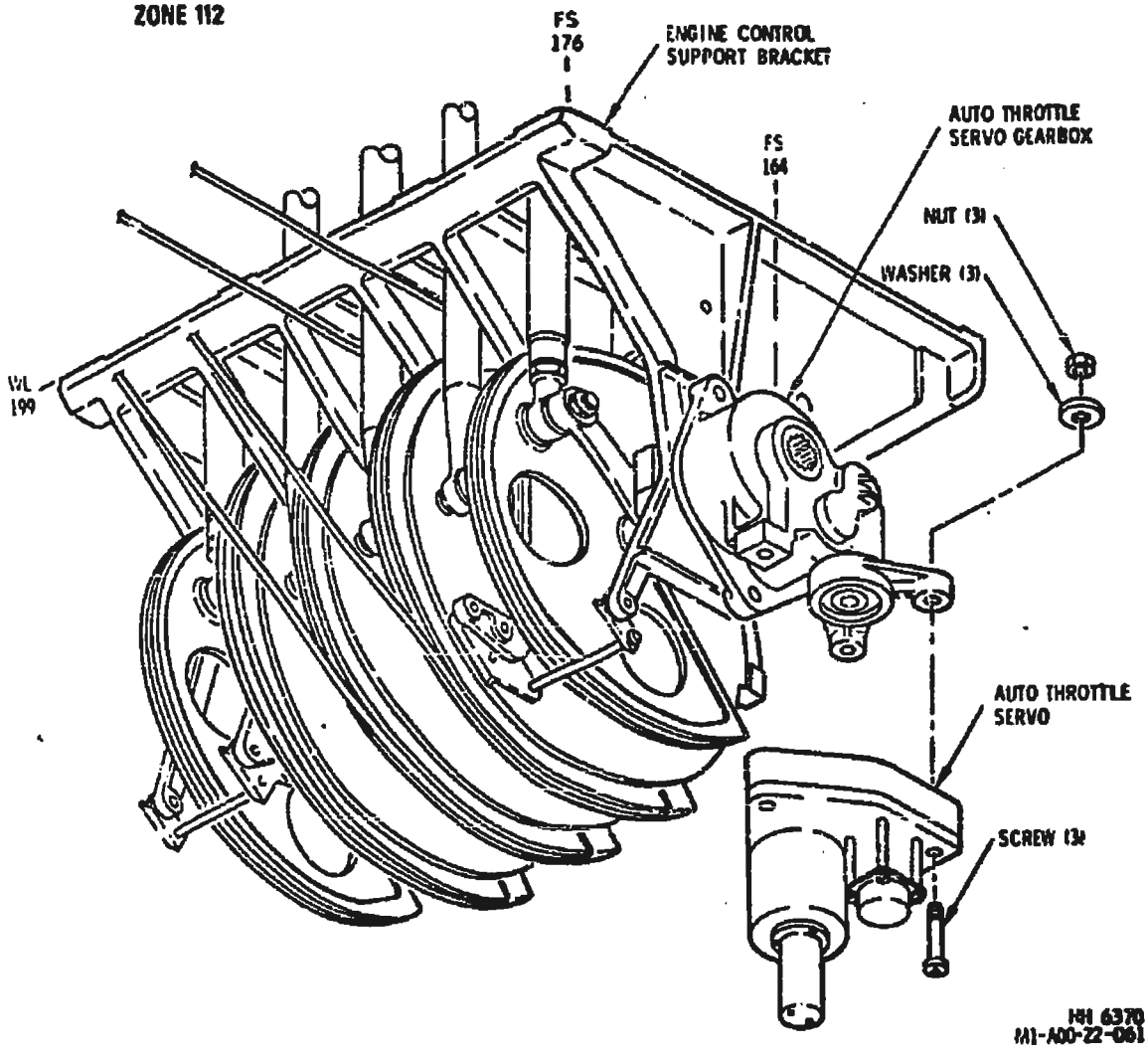
      (5) Close forward electronics service center access door 112AB.

      (6) Remove tags and close circuit breakers opened in Step 2A(1).

R R (7) Perform Autothrottle servo adjustment and test (Ref. 22-31-01).



ZONE 112



Autothrottle Servo Removal and Installation
Figure 401

AUTOTHROTTLE SERVO - ADJUSTMENT AND TEST

1. Equipment and Materials

R Type MB-1 Pitot/Static Field Tester; Burton 2024B Pitot/Static
R Tester; or equivalent (2 req).

2. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-00-00	Electrical Power - Maintenance Practices
29-21-00	Ram Air Turbine - Maintenance Practices
32-63-00	Air/Ground Sensing System - Maintenance Practices
34-13-00	Pitot-Static System Leak Test - Adjustment and Test
34-14-00	Central Air Data Computer System - Maintenance Practices
34-21-00	Attitude Reference System - Maintenance Practices
34-32-00	Radio Altimeter System - Maintenance Practices

3. Adjustment/Test

The autothrottle servo functional test provided below requires that associated equipment are installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

(2) Verify that equipment cooling is on (Ref. 21-25-00).

(3) Verify that the following navigation systems are on:

Central Air Data Computer System (Ref. 34-14-00)

Attitude Reference System (Ref. 34-21-00)

Radio Altimeter System (Ref. 34-32-00)

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breaker FLIGHT STATION MISC - R AOA (F1) is closed.

(5) On pilots overhead circuit breaker panel CB1 open and tag MISC RAT AUTO DEPLOY (L3) circuit breaker.

(6) Install rat ground safety lock (Ref. 29-21-00).

(7) Simulate aircraft in air condition (Ref. 32-63-00).

(8) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

B. Functional Test

(1) Connect testers to CADC systems No. 1 and 2 (Ref. 34-13-00). On each tester, establish an IAS of 170 knots (Ref. 34-13-00).

(2) On THRUST panel, set IAS knob to 170 knots.

(3) Set all throttles to mid-position.

(4) On APFDS ENGAGE panel, set both AP and both FD switches to OFF.

R WARNING: VERIFY THAT TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(5) Ensure that flaps are fully retracted.

(6) On FCES panel, ensure that ATS 1 and 2 switchlights are on. (OFF lights are out).

(7) On THRUST panel, set ATS switch to ON. ATS switch remains in ON position. On both ADIs, speed flag is masked out of view, and FAST/SLOW displays are centered.

(8) On THRUST panel, set IAS knob to 180 knots. All throttle levers drive forward to maximum thrust limit and stop. Both ADI FAST/SLOW displays indicate SLOW.

R NOTE: Because of combined system tolerances when any
R two or all three throttles are at the maximum
R thrust limit stop, the ATS may or may not
R disconnect with ATS DISC and a flashing ALERT
R light appearing on the AFCS Warning Indicator
R Display. If the ATS disconnects under those
R conditions, the throttles must be backed off and
R the ATS switch placed in the ON position.

(9) On THRUST panel, set IAS knob to 160 knots. All throttle levers drive aft to minimum thrust limit and stop. Both ADI FAST/SLOW displays indicate FAST.

(10) On left throttle handle, depress autothrottle disengage switch twice. On THRUST panel, ATS switch drops to OFF.

(11) Disconnect testers from CADC systems No. 1 and 2 (Ref. 34-13-00).

C. Test Completion

(1) Return airplane to on ground condition (Ref. 32-63-00).

(2) Remove rat ground safety lock (Ref. 29-21-00).

(3) In FESC, center rack, set LRS computer BITE switch to RESET for 5 seconds then return to RUN. Verify that CADC fail indicator on LRS computer has reset (BLACK).

(4) On pilots overhead circuit breaker panel CB1, close MISC RAT AUTO DEPLOY (L3) and RADIO ALTM (D4) and (D22) circuit breakers.

(5) Turn off electrical power (Ref. 24-00-00).

AUTOTHROTTLE CLUTCH ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Engine Power Control Rigging Kit, PN B996, or equivalent

2. Referenced Procedures

22-31-01	Autothrottle Servo - Removal and Installation
22-31-02	Autothrottle Clutch Assembly - Adjustment and Test
22-31-04	Autothrottle Servo Gearbox - Removal and Installation
76-11-00	Engine Control System - Adjustment and Test

3. Removal/Installation

R NOTE: If all tension is to be removed from cable system, install a suitable spacer around the tension regulator lockshaft before relieving the tension to prevent bottoming of the regulator. Attach a red flag to the spacer to assure that it is removed after the cable system has been re-tensioned. Avoid twanging of the cable or sudden release or application of cable tension because it can actuate the surge lock on the cable tension regulator. To release the surge lock, apply equal tension on both the power-advance and power-retard cables until the indicator on the regulator begins to move. Release tension on both cables slowly.

A. Removal

(1) On pilot overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS - SPEED CONT (A2)

NO. 2 SYSTEMS - SPEED CONT (A20)

(2) Open access door 112AB, and enter forward electronic service center. Locate autothrottle clutch assemblies on engine power control support bracket directly below

pilots throttle control area near service center ceiling (Ref. Fig. 401).

(3) Relieve tension on engine power control cables attached to autothrottle clutch assembly to be removed (Ref. 76-11-00).

(4) Locate engine power control cable guard pin on engine control support bracket. Remove cotter pin and washer from one end of guard pin, and remove guard pin.

(5) Tag engine power control cables.

(6) Remove cotter pin and disconnect cable from each cable holder on clutch assembly.

(7) Rotate clutch assembly, if necessary, to gain access to engine power control position switch push rod attaching point. Remove cotter pin, nut, and washer, and disconnect push rod.

(8) Rotate clutch assembly, if necessary, to gain access to engine power control manual input rod attaching point. Remove cotter pin, nut, and washer, and disconnect manual input rod.

(9) Remove autothrottle servo (Ref. 22-31-01) and autothrottle servo gearbox (Ref. 22-31-04).

(10) Pull out splined servo drive shaft.

(11) Remove bolts and washers securing bearing caps. Support clutch assembly when releasing second bearing cap.

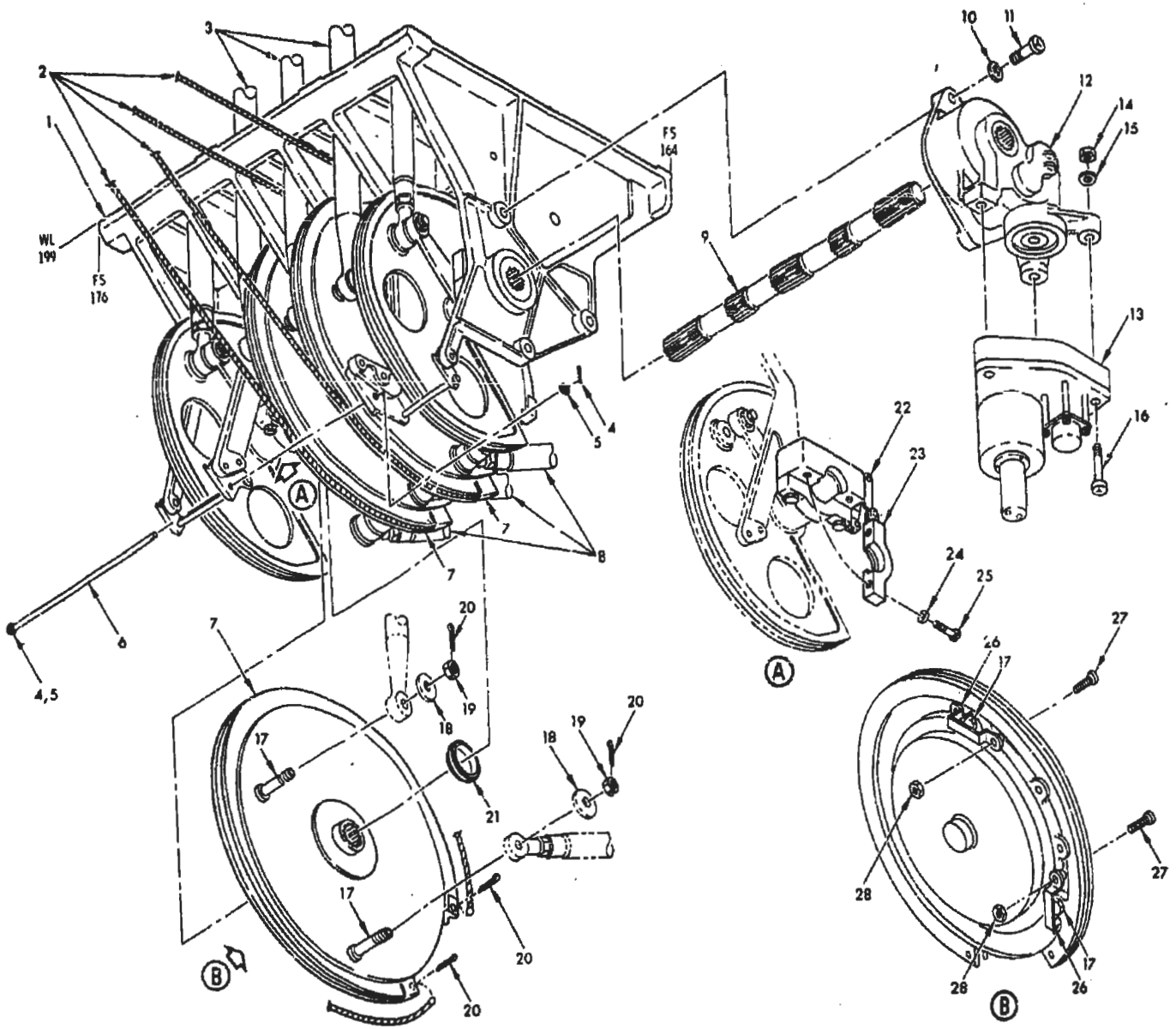
(12) Lower clutch assembly out of engine control support bracket.

(13) Remove ball bearings from clutch assembly and retain for reinstallation.

B. Installation

(1) Verify that circuit breakers opened in Step 3(A)1 are open and tagged.

(2) If not already installed, install bolts to connect engine power control manual input rod and engine power control position switch push rod to clutch assembly as follows (Ref. Fig. 401):



1 ENGINE CONTROL SUPPORT BRACKET
2 ENGINE POWER CONTROL CABLE
3 PUSHROD (ENGINE POWER CONTROL LEVER)
4 COTTER PIN
5 WASHER
6 CABLE GUARD PIN
7 AUTOTHROTTLE CLUTCH ASSEMBLY
8 PUSHROD (ENGINE POWER CONTROL POSITION SWITCH)
9 SPLINED SERVO DRIVE SHAFT
10 WASHER (3)
11 SCREW (3)
12 AUTOTHROTTLE SERVO GEARBOX (REF.)
13 AUTOTHROTTLE SERVO (REF.)
14 NUT (3)
15 WASHER (3)
16 BOLT (3)
17 BOLT
18 WASHER
19 NUT
20 COTTER PIN
21 BALL BEARING (2)
22 BEARING CAP HOLDING STRAP
23 BEARING CAP
24 WASHER (2)
25 BOLT (2)
26 BOLT RETAINER
27 SCREW
28 NUT

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R Autothrottle Clutch Assembly - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

050

(a) Release bolt retainer on clutch assembly by removing nut and screw.

(b) Swivel bolt retainer on rivet.

(c) Install rod-connecting bolt.

(d) Swivel back bolt retainer over bolt head, and secure with screw and nut (nut on bolt retainer side).

(3) Install ball bearings on clutch assembly (Ref. Fig. 401).

(4) Orient clutch assembly with clutch drum facing left, and position onto engine control support bracket.

(5) As clutch assembly is being positioned into the support bracket, install and attach upper control cable
R ensuring that cable lies in clutch assembly cable sheave.

(6) Position one of the two bearing caps over ball bearing, and secure with washers and bolts.

(7) Position second bearing cap and secure with washers and bolts.

(8) Lock-wire bearing cap bolts.

(9) Install engine power control manual input rod on bolt installed on clutch assembly, and secure with washer and nut. Align slot on nut with pin hole in bolt, and install cotter pin.

(10) Install engine power control position switch push rod on bolt installed on clutch assembly, and secure with washer and nut. Align slot on nut with pin hole in bolt, and install cotter pin.

R (11) In flight station, verify that all engine power control levers are in idle position, and speedbrake lever and flap control handle are in 0-degree position.

(12) Insert rigging pin through rigging pin slot in engine control support bracket (left side), speedbrake quadrant, clutch assemblies, flap quadrant, and support bracket (right side).

R (13) Insert splined drive shaft.

(14) Remove tags and install engine power control cables in cable holders on clutch assembly, and install cotter pin on each cable holder.

(15) Install engine power control cable guard pin on support bracket, and secure with washer and cotter pin.

(16) Install autothrottle servo gearbox (Ref. 22-31-04) and autothrottle servo (Ref. 22-31-01).

(17) Ensure that control cables are in clutch assembly cable sheave and in pulleys along cable runs, then perform cable rigging procedures (Ref. 76-11-00).

R (18) Remove rigging pin installed in Step 3B(10).

(19) Close access door.

R (20) Perform autothrottle servo adjustment and test (Ref. 22-31-01).

THRUST SELECT PANEL - REMOVAL AND INSTALLATION

1. Referenced Procedures

   22-31-03 Thrust Select Panel - Adjustment and Test

2. Removal/Installation

   A. Removal

R

   (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker AVIONICS FLIGHT CONTROL SYSTEM - AUTO THROT SERVO (A1),

   (2) Release captive screws on THRUST select panel located on glareshield panel, zone 210.

   (3) Pull THRUST select panel out of glareshield panel to disconnect electrical connector, and remove panel.

   B. Installation

   (1) Verify that circuit breaker opened in Step A(1) is open and tagged.

   (2) Connect electrical connector to THRUST select panel.

   (3) Insert THRUST select panel into glareshield panel and secure with captive screws.

   (4) Remove tag and close circuit breaker opened in Step A(1).

   (5) Perform thrust select panel adjustment and test (Ref. 22-31-03).

THRUST SELECT PANEL - ADJUSTMENT AND TEST

1. Referenced Procedures

R R	21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
	24-00-00	Electrical Power - Maintenance Practices
	29-11-00	Hydraulic Power System - Maintenance Practices
	32-63-00	Air/Ground Sensing System - Maintenance Practices
	34-14-00	Central Air Data Computer System - Maintenance Practices
	34-21-00	Attitude Reference System - Maintenance Practices
	34-32-00	Radio Altimeter System - Maintenance Practices

2. Adjustment/Test

The THRUST select panel operational test provided below requires that associated equipment is installed and operational.

A. Preparation

(1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that equipment cooling is on (Ref. 21-25-00).

(3) Verify that the following navigation systems are on:

Central Air Data Computer System (Ref. 34-14-00)

Attitude Reference System (Ref. 34-21-00)

Radio Altimeter System (Ref. 34-32-00)

(4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS - SPEED CONT (A2)

FCES - COMPUTERS - AC & L AOA (B5)

NO. 2 SYSTEMS - SPEED CONT (A20)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breaker FLIGHT STATION MISC - R AOA (F1) is closed.

B. Operational Test

(1) On APFDS ENGAGE panel, set FD A and B switch to ON.

(2) On pilots control wheel, depress TAKEOFF/GO AROUND switch. On THRUST panel, ALPHA flag comes in view. On both AFCS MODES annunciators, TAKEOFF indications are displayed.

(3) On AP FDS ENGAGE panel, set both FD switches to OFF. On THRUST panel, ALPHA flag goes out of view. On both AFCS MODES annunciator, indications are removed.

(4) On pilots overhead circuit breaker panel CB1, zone 210, open and tag MISC - RAT AUTO DEPLOY (L3) circuit breaker.

(5) Install rat ground safety lock (Ref. 29-21-00).

(6) Simulate aircraft in air condition (Ref. 32-63-00).

(7) Ensure that Captains and First Officers IAS indicators display 60 knots.

(8) On THRUST panel, set IAS knob to 100 knots.

(9) Set all throttles to mid-position.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(10) Turn on hydraulic systems A and C (Ref. 29-11-00).

(11) Position flap handle full forward for zero flap position.

(12) On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(13) On FCES panel, ensure that ATS 1 and 2 switchlights are on. (OFF lights out).

WARNING: ENSURE THAT AUTOTHROTTLE CLUTCH ASSEMBLY AREA IS CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(14) On THRUST panel, set ATS switch to ON. ATS switch remains in ON position. The three throttle levers drive forward to maximum thrust limit and stop. Both ADI FAST/SLOW displays indicate SLOW.

R NOTE: Because of combined system tolerances when any
R two or all three throttles are at the maximum
R thrust limit stop, the ATS may or may not
R disconnect with ATS DISC and a flashing ALERT
R light appearing on the AFCS Warning Indicator
R Display. If the ATS disconnects under these
R conditions, the throttles must be backed off and
R the AFCS switch placed in the ON position.

(15) On left throttle handle, depress ATS disengage switch twice. On THRUST panel, ATS switch drops to OFF.

C. Test Completion

(1) Return airplane to on ground condition (Ref. 32-63-00).

(2) Remove rat ground safety lock (Ref. 29-21-00).

(3) On pilots overhead circuit breaker panel CB1, remove tag and close MISC - RAT AUTO DEPLOY (L3) circuit breaker, and close RADIO ALTM (D4) and (D22) circuit breakers.

(4) Turn off electrical power (Ref. 24-00-00).

AUTOTHROTTLE SERVO GEARBOX - REMOVAL AND INSTALLATION

1. Referenced Procedure

22-31-01 Autothrottle Servo - Removal and Installation

R 22-31-01 Autothrottle Servo - Adjustment and Test

2. Removal/Installation

A. Removal

(1) Remove autothrottle servo (Ref. 22-31-01), and set aside for reinstallation (Ref. Fig. 401).

(2) Support autothrottle servo gearbox, remove mounting screws and washers, and remove gearbox.

NOTE: Gearbox separates from interfacing splined drive shaft when pulled.

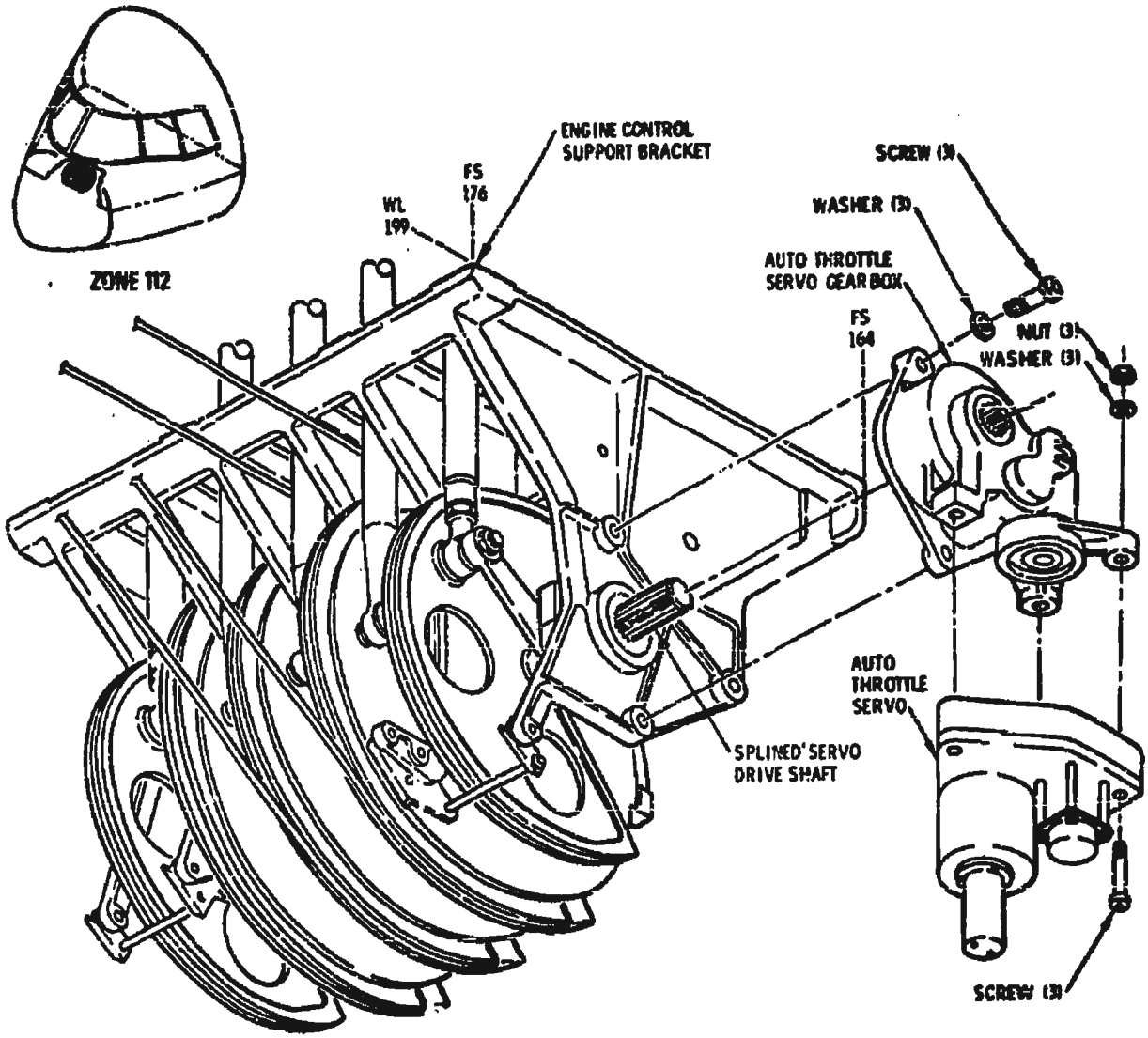
B. Installation

(1) Position gearbox (Ref. Fig. 401) against engine control support bracket assembly, with gearbox output mated to interfacing splined drive shaft and mounting holes aligned.

(2) Install and tighten mounting screws and washers.

(3) Reinstall autothrottle servo (Ref. 22-31-01).

R R (4) Perform autothrottle servo adjustment and test (Ref. 22-31-01).



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Autothrottle Servo Gearbox Removal and Installation
Figure 401

EFFECTIVITY: ALL

050B

LONGITUDINAL ACCELEROMETER UNIT - REMOVAL AND INSTALLATION

1. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust System - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices
34-21-00	Attitude Reference System - Adjustment and Test

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

R

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

No. 1 SYSTEMS - SPEED CONT (A2)

No. 2 SYSTEMS - SPEED CONT (A20)

(2) Open GYROSCOPE ACCESS PANEL in galley ceiling, zone 135.

(3) Disconnect electrical connectors from accelerometer (Ref. Fig. 401).

R (4) Remove mounting screws and remove accelerometer.

B. Installation

The longitudinal accelerometer installation procedure includes operational test of the accelerometer. The test requires that all other autoflight system components and associated equipment are installed and operational.

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Connect electrical connectors to accelerometer.

(3) Turn on electrical power (Ref. 24-41-00).

(4) Verify that avionics cooling is on (Ref. 21-25-00).

(5) Verify that attitude reference system is on (Ref. 34-21-00).

(6) Remove tags and close circuit breakers opened in Step 2A(1).

(7) On pilots overhead circuit breaker panel CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(8) On FCES control panel, verify that ATS 1 and 2 switchlights are on (latched in) with no FAIL legend annunciated.

(9) Orient accelerometer in direction of mounting.

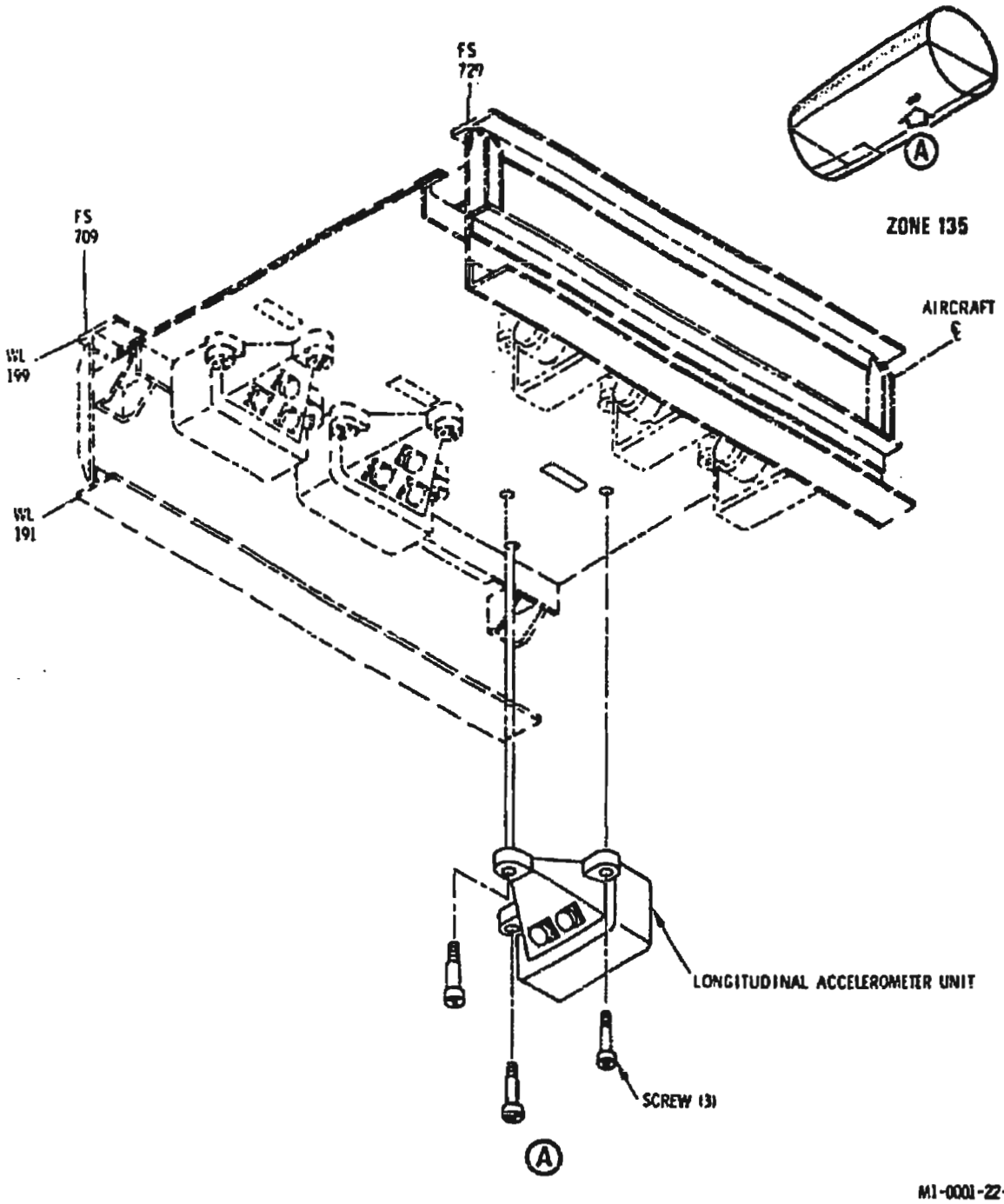
(10) Tilt accelerometer, forward end up, approximately 60 degrees to simulate aircraft nose up attitude. While accelerometer is being tilted, verify that fast/slow indicator on both ADI indicates fast.

(11) Turn off electrical power (Ref. 24-41-00).

R (12) Position accelerometer on mount and secure with mouning
R screws (Ref. Fig. 401).

(13) Close GYROSCOPE ACCESS PANEL.

(14) On CB1, close D4 and D22 circuit breaker.



R Longitudinal Accelerometer Unit - Removal and Installation
R Figure 401

ANGLE-OF-ATTACK SENSOR - REMOVAL AND INSTALLATION

1. Equipment and Materials

Soft clean rags

Plastic scraper

Solvent, methyl-ethyl-keytone, Fed Spec T T-M-261, or equivalent

Solvent, Trichloroethane, Fed Spec O-T-620 1,1,1, or equivalent

Aerodynamic Sealant, LAC Spec C-40-1279, or equivalent

R O-ring, P/N MS28775-022, or equivalent

2. Referenced Procedure

22-31-06 Angle-of-Attack Sensor - Adjustment and Test

51-25-00 L-1011 Structure Repair Manual - Structural Sealing

3. Removal/Installation

A. Removal

(1) To remove left angle-of-attack sensor, open and tag the following circuit breakers:

On pilots overhead circuit breaker panel CB1, zone 210, AVIONICS FLIGHT CONTROL SYSTEM - FCES - COMPUTERS - AC & L AOA (B5)

On Flight Engineer/Second Officers overhead circuit breakers panel CB2, zone 215, ANTI-ICE - LEFT ALPHA HEAT (E12)

To remove right angle-of-atack sensor, open and tag the following circuit breakers:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, FLIGHT STATION MISC - R AOA (F1) and ANTI-ICE - RIGHT ALPHA HEAT (E22)

(2) On fuselage external surface, locate angle-of-attack sensor installation panel, zone 112, through which sensor probe is protruding (Ref. Fig. 401).

(3) Remove screws securing installation panel to fuselage.

(4) Pull out installation panel/sensor assembly, and disconnect electrical connector from sensor.

(5) Loosen nuts securing sensor to mounting plate (riveted to installation panel), and release sensor from alignment pins.

(6) Rotate sensor until recesses of sensor flange clear washers, and remove sensor.

(7) Use plastic scraper to remove sealant from fuselage structure. Use soft clean rag saturated with MEK to wipe fuselage structure clean. Do not allow MEK to air dry on surface; wipe dry with soft clean dry rag.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Install a new pressure seal O-ring in its groove on the mounting plate (Ref. Fig. 401).

(3) Place sensor flange on far side of washers through recessed areas.

R CAUTION: CARE MUST BE TAKEN TO INSURE THAT THE ALIGNMENT PINS, LOCATED IN EACH MOUNTING PLATE, ARE ACTUALLY INSERTED INTO THE MOUNTING HOLES IN THE FLANGE OF THE ANGLE-OF-ATTACK (AOA) SENSOR. WHEN THE AOA SENSOR IS PROPERLY ALIGNED, NO DIFFICULTY WILL BE EXPERIENCED IN TIGHTENING THE FOUR MOUNTING BOLTS, NOR WILL THE PINS BE FORCED OUT OF THE FRONT SIDES OF THE MOUNTING PLATE.

(4) Rotate sensor until sensor alignment holes coincide with alignment pins.

(5) Tighten nuts to secure sensor on mounting plate.

(6) Using a clean soft rag saturated with trichloroethane solvent, clean faying surfaces of fuselage structure and installation panel for electrical bond. Do not allow solvent to air dry; wipe clean with soft clean dry rag.

(7) Connect electrical connector to sensor.

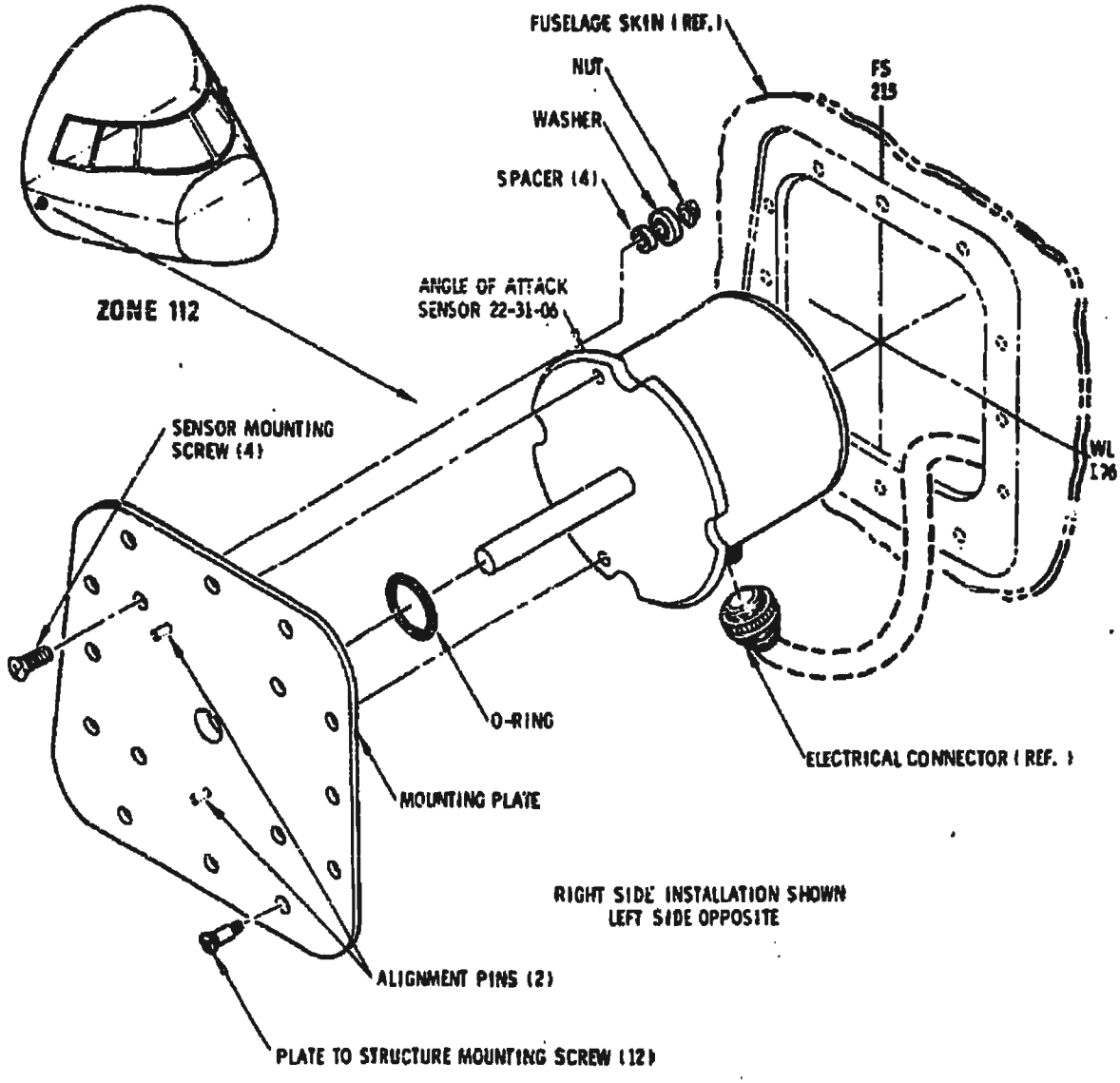
(8) Insert sensor through opening and place installation panel against fuselage.

R (9) Secure installation panel to fuselage with screws.

R (10) Apply a bead of aerodynamic sealant to space (gap) between installation panel and aircraft structure.

(11) Remove tags and close circuit breakers opened in Step 3A(1).

(12) Perform angle-of-attack sensor operational test (Ref. 22-31-06, Adjustment and Test).



M1-0100-22-201

R Angle-of-Attack Sensor - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

ANGLE-OF-ATTACK SENSOR - ADJUSTMENT AND TEST

1. Referenced Procedures

21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Adjustment and Test
24-41-00	External Power/Ground Service System - Maintenance Practices

2. Adjustment/Test

The angle-of-attack sensor operational test provided below requires that all other autoflight system components and associated equipment are installed and operational.

R There are two angle-of-attack sensors installed for autoflight operations. Testing an angle-of-attack sensor requires that only the associated systems be turned on (No. 1 systems for sensor No. 1 and No. 2 systems for sensor No. 2). If both systems are already on, the system on-off may be controlled with the STALL WARN switchlights on the FCES control panel. The operational test procedure provided below applies to both sensors with applicable differences noted.

A. Operational Test

(1) Turn on electrical power (Ref. 24-41-00).

(2) Verify that avionics cooling is on (Ref. 21-25-00).

(3) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

AVIONICS FLIGHT CONTROL SYSTEM

FCES

COMPUTERS - DC (B4)

COMPUTERS - AC & L AOA (B5) (for sensor No. 1 only)

STICK SHAKE (B6) (for sensor No. 1 only)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that the following circuit breakers are closed:

FLIGHT STATION MISC

R AOA (F1) (for sensor No. 2 only)

STICK SHAKE (F2) (for sensor No. 2 only)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IND LT - FLT CONT/ALT ALERT is closed.

(4) On FCES control panel, verify that both STALL WARN switchlights are on (latched in).

(5) Release STALL WARN 2 (for sensor No. 1 test) or STALL WARN 1 (for sensor No. 2 test) switchlight to OFF, leaving other switchlight on. Release DLC/AUTO SPLR switchlights 1 and 2 to OFF.

(6) On FCES control panel, depress and hold stall warning TEST switch. Verify that Captains (for sensor No. 1 test) or First Officers (for sensor No. 2 test) control column vibrates.

(7) Release TEST switch.

(8) Depress STALL WARN switchlight turned OFF in Step (5) to on.

(9) Perform air data sensor heat system adjustment and test (Ref. 30-31-00).

(10) Turn off electrical power (Ref. 24-41-00).

SPEED CONTROL COMPUTER - REMOVAL AND INSTALLATION

1. Referenced Procedures

29-11-00 Hydraulic Power System - Maintenance Practices

34-21-00 Attitude Reference System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICS FLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1 SYSTEMS - SPEED CONT (A2)

NO. 2 SYSTEM - SPEED CONT (A20)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breakers AFCS WARNING - CAPT (K18) and AFCS WARNING - F/O (K19).

(2) Open access door 112B and enter forward electronic service center, zone 112. Locate computer in center rack (Ref. Fig. 401).

(3) Release holddowns on computer front panel.

(4) Pull computer handle to release computer electrical connectors from mount connectors.

(5) Slide computer out of mount.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Slide computer (Ref. Fig. 401) into mount until computer electrical connectors mate with mount connectors.

(3) Secure computer with holddowns.

(4) Close access door.

(5) Remove tags and close circuit breakers opened in Step A(1).

(6) Perform operational test in Step C.

C. Operational Test

WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(1) Turn on hydraulic systems A, B, C and D (Reference 29-11-00).

(2) Ensure that flaps are less than 30 degrees. On CB1, open RADIO ALTM (D4) and (D22) circuit breakers.

(3) Verify that the attitude reference system is on (Ref. 34-21-00).

(4) On FCES panel, depress STALL WARN 1 and 2 switchlights to on.

(5) On FCES panel, depress and hold STALL WARN TEST switch for approximately 5 seconds.

NOTE: Minor disturbances such as gusts of wind or servo inbalance may drive the AOA probes from the required test position. Reposition AOA probes during Steps (6) thru (8) as required by depressing and holding STALL WARN TEST switch.

(6) On FCES panel, depress ATS 1 and 2 switchlights to OFF, then ON.

RESULT:

OFF lights come on in off position, and switchlights are dark in on position.

On THRUST select panel, ALPHA flag is in view.

(7) Close D4 and D22 circuit breakers. On APFDS ENGAGE panel, set FD A and FD B switches to ON.

RESULT:

Both ADI command bars come into view and are level.

(8) On Captains control wheel, depress TO/GA switch.

RESULT:

On both AFCS MODES annunciators, TAKEOFF messages are displayed.

CR CR On both ADI SLOW-FAST indicators remain in slow position.

R On both ADI, command bars indicate fly up when flaps are set at 4 degrees. For flap setting of zero or 14 degrees, and higher, command bars may show level or slightly fly down.

(9) Set FD A and B switches to OFF.

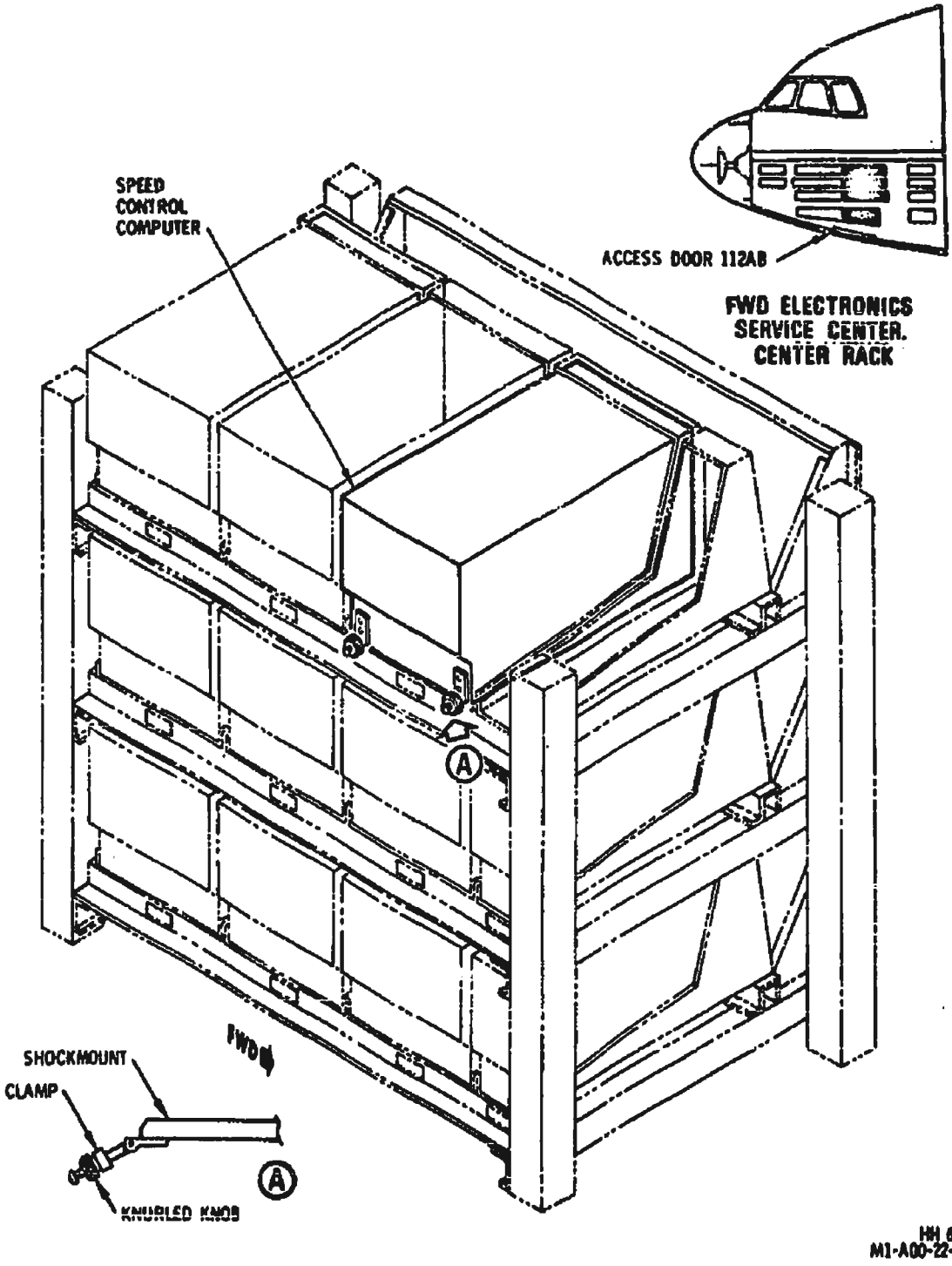
(10) Move throttle levers to mid-position.

(11) On THRUST Panel engage ATS bat handle.

RESULT:

Throttle levers drive aft.

(12) Turn off hydraulic systems.



Speed Control Computer - Removal and Installation
Figure 401

AUTOTHROTTLE DISENGAGE SWITCH - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R 22-31-08 Autothrottle Disengage Switch - Adjustment/Test

R 2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICSFLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1)

NO. 1-PA SYSTEMS - SPEED CONT (A2)

NO. 2 SYSTEMS - SPEED CONT (A20)

(2) Offset applicable engine power control lever knob, zone 211, from other engine power control lever knobs (Ref. Fig. 401).

(3) Remove screws securing power lever knob cap, and remove cap.

(4) Disconnect wires from switch terminals.

(5) Unscrew switch from lever knob.

B. Installation

(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Position knob on lever (relief on knob) and screw switch into knob through lever (Ref. Fig. 401).

(3) Connect wires to switch terminals.

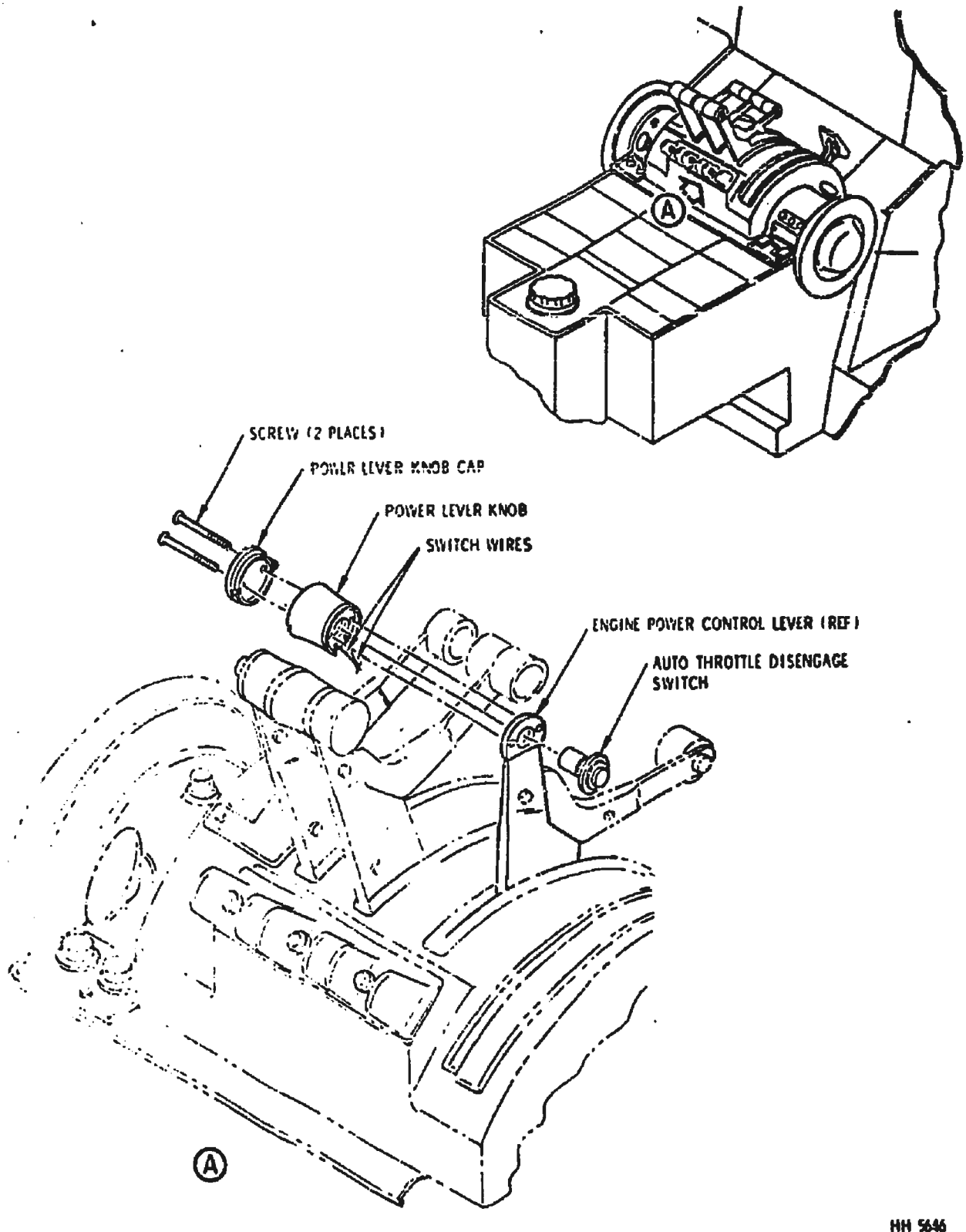
(4) Install cap on knob (key provided).

(5) Secure cap with screws.

(6) Return power control lever to 0-degree position.

(7) Remove tags and close circuit breakers opened in Step A(1).

(8) Perform autothrottle disengage switch adjustment and test (Ref. 22-31-08).



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Autothrottle Disengage Switch - Removal and Installation
Figure 401

R AUTOTHROTTLE DISENGAGE SWITCH - ADJUSTMENT AND TEST

R 1. Referenced Procedures

R	21-00-00	Air Conditioning - Maintenance Practices
R	24-00-00	Electrical Power - Maintenance Practices
R	29-11-00	Hydraulic Power System - Maintenance Practices
R	29-21-00	Ram Air Turbine - Maintenance Practices
R R	34-14-00	Central Air Data Computer System - Maintenance Practices
R	34-32-00	Radio Altimeter System - Maintenance Practices

R 2. Adjustment/Test

R R The autothrottle servo functional test provided below requires that associated equipment are installed and operational.

R A. Preparation

R (1) Turn on electrical power (Ref. 24-00-00).

R (2) Verify that equipment cooling is on (Ref. 21-00-00).

R (3) Verify that the following navigation systems are on:

R Central Air Data Computer System (Ref. 34-14-00)

R Radio Altimeter System (Ref. 34-32-00)

R R (4) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

R AVIONICS FLIGHT CONTROL SYSTEM

R AUTO THROT SERVO (A1)

R NO. 1 SYSTEMS - SPEED CONT (A2)

R FCES - COMPUTERS - AC & L AOA (B5)

R NO. 2 SYSTEMS - SPEED CONT (A20)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breaker FLIGHT STATION MISC - R AOA (F1) is closed.

(5) On pilots overhead circuit breaker panel CB1 open and tag MISC RAT AUTO DEPLOY (L3) circuit breaker.

(6) Install rat ground safety lock (Ref. 29-21-00).

(7) Simulate "airborne" condition by either removing the AFCS/MLG ACCESSORY UNIT or by opening MLG GND SENSE (L8) or GEAR TRUCK LEVEL (F16) circuit breaker on CB2 panel.

(8) On CB1, open NO. 1 NAVIGATION RADIO ALTM (D4) circuit breaker.

R WARNING: VERIFY THE FOLLOWING BEFORE PRESSURIZING ANY HYDRAULIC SYSTEM:

LANDING GEAR DOWNLOCK SAFETY PINS AND DOOR SAFETY DEVICES ARE INSTALLED.

TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

THE AFFECTED HYDRAULIC SYSTEMS CAN ACCEPT HYDRAULIC PRESSURE.

(9) Turn on hydraulic power (Ref. 29-11-00).

R WARNING: VERIFY THAT TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES ARE CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(10) Set flaps to zero degrees.

(11) On APFDS ENGAGE panel, verify that both AP and FD switches are OFF.

(12) On all mode selector panels, set mode selector switch to ATT. When both ADI ATT flags go out-of-view and ATT 3 (VG-3) legend goes out, continue test.

B. Functional Test

(1) On FCES panel, verify that ATS 1 and ATS 2 switchlights are on (dark).

R WARNING: ENSURE THAT AUTOTHROTTLE CLUTCH ASSEMBLY AREA IS CLEAR OF PERSONNEL AND GROUND EQUIPMENT.

(2) Set all throttle levers to mid-position.

(3) On glareshield panel left section, set ATS bat handle to ATS. ATS bat handle remains in ATS position.

(4) On left or right throttle handle, press twice the autothrottle switch under test. ATS bat handle drops to off.

C. Test Completion

R (1) Return airplane to "on ground" condition by reversing
R Step 2A(7).

(2) Remove rat ground safety lock (Ref. 29-21-00).

(3) On pilots overhead circuit breaker panel CB1, close MISC RAT AUTO DEPLOY (L3) and NO. 1 NAVIGATION RADIO ALTM (D4) circuit breakers.

(4) Turn off electrical power (Ref. 24-00-00).

POWER CONTROL LEVER SWITCH - REMOVAL AND INSTALLATION

1. General

The power control lever switches, grouped in three identical sections and controlled by reel-type cams, are located below the autothrottle clutch assemblies in the forward electronic service center, zone 112. The switches in each group are identified with numbers. The switches used with the autothrottle system are numbered 4, 5, 6, and 12. The switches used with the flight control electronics system are numbered 7, 8, 9, and 10.

The removal and installation procedure provided below applies to any one of the switches, however, the opening of circuit breakers before a switch removal differs as noted.

2. Referenced Procedures

20-24-02	Crimped Contact - Removal and Insertion
34-44-01	Weather Radar Receiver-Transmitter - Removal and Installation
76-11-06	Engine Control System - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

AVIONICSFLIGHT CONTROL SYSTEM

AUTO THROT SERVO (A1) (for all switches)

FCES - COMPUTERS - AC & L AOA (B5) (for switch No. 9 and 10 removal only)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker FLIGHT STATION MISC - R AOA (F1) (for switch No. 7 or 8 removal only).

(2) Open access door 112AB.

(3) Remove weather radar receiver-transmitter No. 1 and No. 2 from top shelf of forward electronic service center forward rack (Ref. 34-44-01).

(4) Remove drip shield from top of forward rack.

R WARNING: ENSURE THAT ENGINE POWER CONTROL LEVERS ARE NOT OPERATED DURING SWITCH REMOVAL.

(5) Release switch arm (for switch to be removed) from cam support assembly by removing screw, spring, and washer (Ref. Fig. 401).

(6) Rotate switch arm to provide access to switch attaching hardware.

(7) Remove screws, nuts, and washers to separate switch from switch arm.

NOTE: Switch actuator is attached with same hardware as switch, and comes off when switch is separated. Retain for reinstallation.

(8) Tag and disconnect wires from switch (Ref. 20-24-02).

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

R WARNING: ENSURE THAT ENGINE POWER CONTROL LEVERS ARE NOT OPERATED DURING SWITCH INSTALLATION.

(2) Connect wires to switch (Ref. 20-24-02) and remove wire tags.

(3) Orient and position switch actuator, then switch onto switch arm with mounting holes aligned (Ref. Fig. 401).

(4) Secure switch and switch actuator with screws, washers, and nuts.

(5) Rotate switch arm back to cam support assembly and secure with screw, spring, and washer.

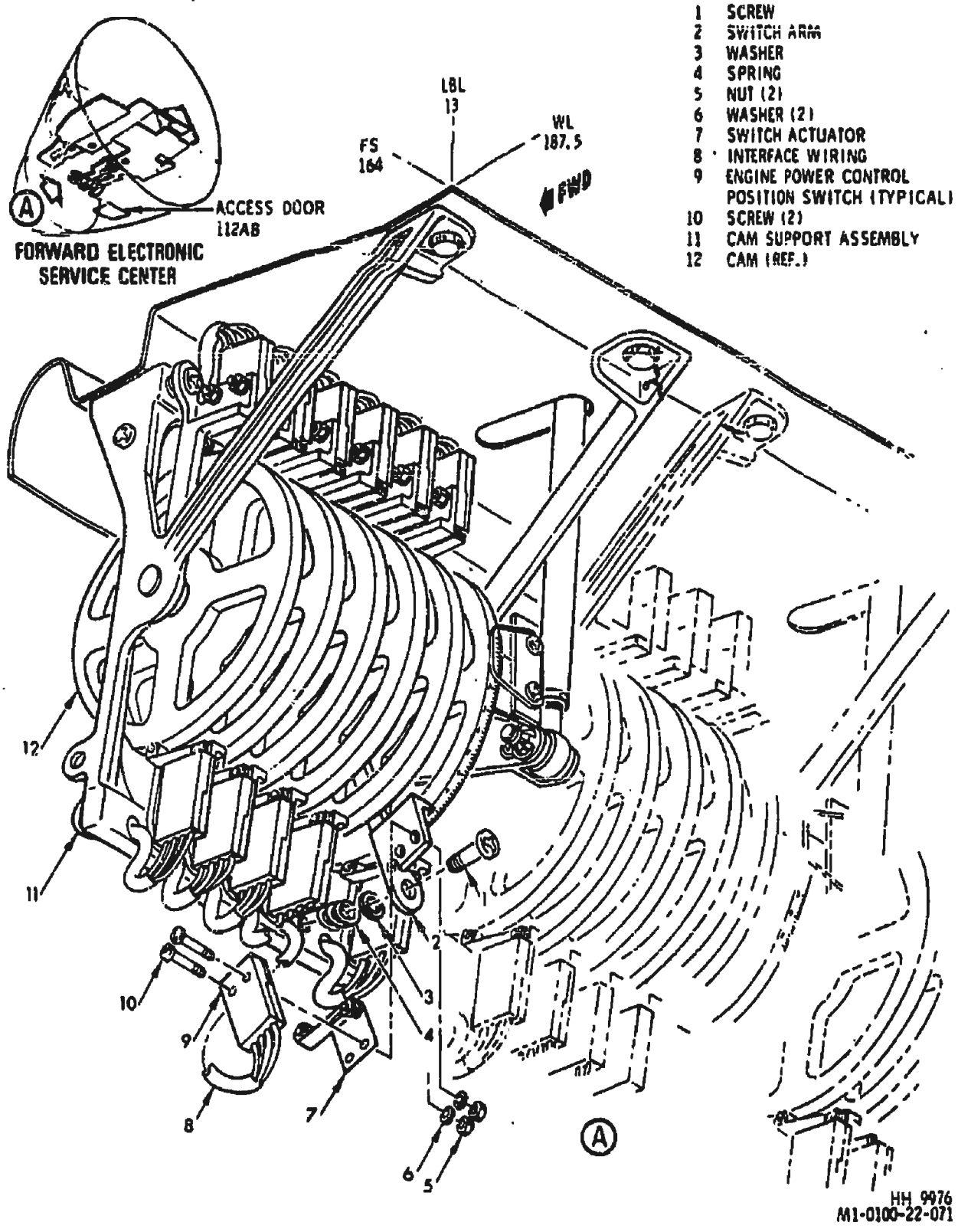
(6) Adjust and test switch as described in 76-11-06,501.

(7) Install drip shield over forward rack.

(8) Install weather radar receiver-transmitter No. 1 and No. 2 on forward rack (Ref. 34-44-01).

R (9) Close access door.

R (10) Remove tags and close circuit breakers opened in Step
R 3A(1).



R Power Control Lever Switch - Removal and Installation
R Figure 401